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An Investigation into the Verb Production of a Man with Aphasia: Evidence  
for a Modality-Specific Deficit

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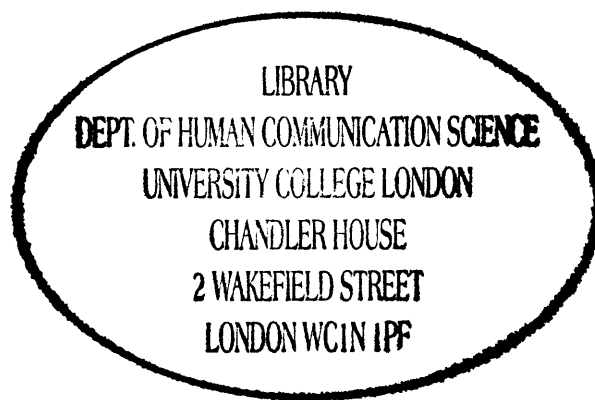
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## **Abstract**

This single case study of KB, a gentleman with acquired anomia, analyses his verb production in written and spoken description tasks and writing to dictation. In the data analysed, he produced main verbs accurately 96.5% of the time in his spoken descriptions while only 28.7% of the time in his written descriptions of the same picture or in the written version of the same task. KB omitted nearly half (47%) of the required main verbs in written tasks, in striking contrast to no verb omissions at all in spoken tasks. The lower percentage correct for verbs, coupled with the unique phenomenon of verb omissions in written output, provide strong evidence of a modality-specific verb deficit. The results are discussed with reference to semantic/conceptual, general syntactic, and Independent Networks (Caramazza, 1997) theories. In addition, a possible summation of phonological and/or orthographic information with semantic information is considered with respect to the error types produced. The evidence from this study does not support purely semantic explanations of noun/verb dissociations, and is consistent with the suggestion that there are separate processing routes from semantics to forms, for nouns and verbs.

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## Introduction

### 1. Introduction

Difficulties with verbs are common in aphasia, and have been reported by many researchers (e.g. Berndt, Haendiges, Mitchum & Sandson, 1997b; Shapiro & Caramazza, 2003; Marshall, Pring & Chiat, 1998). Noun-verb dissociations have been well documented, with either a verb deficit with sparing of nouns, or the opposite pattern (e.g. Caramazza & Hillis, 1991). Black and Chiat (2003) caution that the noun-verb dissociation is best viewed as a continuum of conceptual-semantic, syntactic and phonological properties, rather than a binary distinction. A verb deficit therefore could be due to damage to several levels of language processing, rather than one particular module or level. Due to their complexity, the different patterns of language deficits in aphasia have so far resisted single explanations; rather, different theories and models have been developed to account for different profiles of impairment and preserved ability.

#### 1.1 Semantic/conceptual theories

It is useful to consider some current theories proposed to account for the language deficits observed in aphasia. Some researchers propose that difficulties at the semantic/conceptual level are the source of noun/verb dissociations. For Bird, Howard, & Franklin (2003), verb deficits can be explained by a disadvantage for less imageable items (verbs). They describe patients whose apparent verb deficit was eliminated when imageability was controlled for, and when verbs were removed from their sentence context. Since imageability is thought to be a semantic variable, describing the amount of sensory properties of a concept (Bird et al, 2000, 2003) or its 'sensory richness', their hypothesis proposes a semantic basis to noun/verb dissociations. Bird et al conclude that the patients found the syntactic category difficult due to the type of semantic representation with which it was associated, rather than its syntactic classification. This hypothesis predicts that words of higher imageability enjoy faster and easier activation within the semantic system, regardless of their syntactic category. This hypothesis also predicts that the effect will arise equally across modalities, in other words that there will be no difference between written

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and spoken verb production since any problems arise from the same source in the semantic system.

Marshall, Chiat, Robson and Pring (1996) report a patient, RG, who was argued to have sustained damage to the concrete, perceptual domains of his semantic system, resulting in a disadvantage for concrete words coupled with retained ability with abstract words. This brought about a 'reverse concreteness' effect in noun processing (e.g. concrete '*medical notes*' → abstract substitution '*list of fictions*') and a relative advantage for verbs. The authors argued that the apparent word class effect displayed by RG was a symptom of his semantic abilities and impairments. This explanation considers that, depending on the locus of impairment, more imageable or more concrete words can actually be more difficult for some patients, such as RG. This again would be predicted to arise across modalities and for comprehension as well as production.

Evidence against the imageability hypothesis has been described by Berndt and colleagues (2002a & 2002b), who reported noun/verb dissociations even when imageability was controlled for, therefore it seems unlikely that imageability alone can account for all cases of noun/verb dissociations.

### **1.2 Syntactic theories**

Verb retrieval could be impaired as a result of a more general syntactic processing deficit, such as those originally proposed to account for the impaired sentence production and verb production observed in Broca's type aphasia (e.g. Myerson & Goodglass, 1972) and agrammatism (Miceli et al., 1984). It has been speculated that the verb retrieval deficit may be causally related to poor sentence production and comprehension (Saffran, 1982). This hypothesis is challenged, however, by evidence that retrieval of verbs need not be influenced by the complexity of the target utterances (Berndt et al 1997a), and by the fact that it has difficulty explaining why verb deficits appear in single word tasks (Miceli et al., 1984). Nevertheless, Berndt and colleagues found that patients

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who were poor at producing verbs to name action sequences produced fewer sentences, and simpler sentences, than patients who were better at verb production, and this correlation was statistically significant (Berndt et al., 1997b). Therefore the association between verb production and sentence production is not clear-cut, but it would appear that they are associated for at least some patients.

A different version of the syntactic hypothesis suggests that verbs are more difficult to produce than nouns because of their greater morphological complexity. Evidence from Chinese, an uninflected language where nouns and verbs do not differ from each other in terms of morphology, shows that word class effects occur even when the morphology is the same for each class (Bates et al., 1991). However, some researchers have reported patients for whom a grammatical category difficulty is associated with difficulty in producing morphology for that category, even with pseudowords (Shapiro & Caramazza, 2003), which suggests that "grammatical category-specific deficits can have a purely grammatical basis" (Laiacona & Caramazza, 2004, p.106).

The lexical hypothesis is distinct from a global syntactic deficit hypothesis, and posits that lexical representations for words include specific grammatical category information aside from information relating to their phonology or semantics. This grammatical category information may be stored separately for nouns and verbs, leaving the possibility that one could be selectively impaired while the other could be selectively spared following stroke or other damage (Miceli et al, 1984, 1988; Caramazza & Hillis, 1991; Hillis & Caramazza, 1995). Due to being independent from semantic-conceptual and global syntactic explanations, a lexical hypothesis is compatible with cases of category-specific deficits in patients who are fluent, have fairly intact semantic knowledge, or both.

\* there is a plural morpheme for nouns + they take quantifiers  
verbs can take a tense marker  
past



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### **1.3 Modality-specific findings**

Various researchers have reported subjects with selective deficits for verbs in only one modality of output; the other modality being spared (Caramazza & Hillis, 1991; Marshall, Pring & Chiat, 1998; Rapp & Caramazza, 1998). These studies provide strong support for the idea that syntactic category information is available at the level of modality-specific output lexicons, because the deficit is confined to the production of either phonological or orthographic lexical forms of one syntactic category. For example, Caramazza and Hillis (1991) described two subjects with selective verb output deficits; HW showed selective deficits for verbs in spoken output but not in writing; SJD showed selective deficits for verbs in writing but not in spoken output; both subjects had good comprehension of spoken and written words. Rapp and Caramazza (1998) describe PW, a patient with modality-specific deficits for verbs (in writing). In written scene description, he scored 88% for nouns but only 26% for verbs. In writing to dictation sentence pairs containing noun/verb homonyms, PW was significantly more accurate in writing noun forms (50%) than the identical verb forms (27%) (Chi Squared = 6.38,  $p < 0.012$ ). This latter result indicates that it is highly unlikely that the written verb forms themselves are intrinsically more difficult than the written noun forms.

Modality-specific word class effects pose a problem for the semantic hypothesis, because any semantic difficulty would be expected to manifest itself in all output modalities, and to affect comprehension. Modality-specific verb/noun differences also argue against the existence of lemmas (central representations of grammatical information such as grammatical class), because these should give rise to the same pattern of ability or impairment in both modalities. However, the problem could occur at the lexeme level, where phonological or orthographic forms are retrieved. The existence of these modality-specific cases, together with other evidence, has led to rejection of the lemma level of processing in favour of an alternative model that does not make use of a central lexical component (Caramazza, 1997). The Independent Networks (IN) Hypothesis by Caramazza and colleagues (Rapp & Caramazza, 2002; Shapiro & Caramazza, 2003) is a

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theory to explain noun/verb dissociations (especially modality-specific ones) and suggests that grammatical category information is available at the level of the modality specific output lexicons. The independent networks consist of lexical forms and syntactic information (including syntactic category). The IN hypothesis explains the occurrence of modality specific grammatical impairments by selective damage to one lexicon and its associated syntactic network, although it doesn't account for impairments across modalities (see Figure 1 below).

In addition to the IN hypothesis, Rapp and Caramazza (1998) describe another hypothesis regarding modality-specific aspects of syntactic category representation and processing. The IN hypothesis is consistent with phonological and orthographic *stores* of lexical forms being organised according to syntactic category. The other possibility is that the word stores themselves are not organised according to syntactic category, but instead the *pathways* for retrieving the written or spoken nouns or verbs are distinct from each other. Thus, a verb problem specific to written output could occur due to damage to the pathway for retrieving orthographic forms of verbs from the orthographic lexical store.

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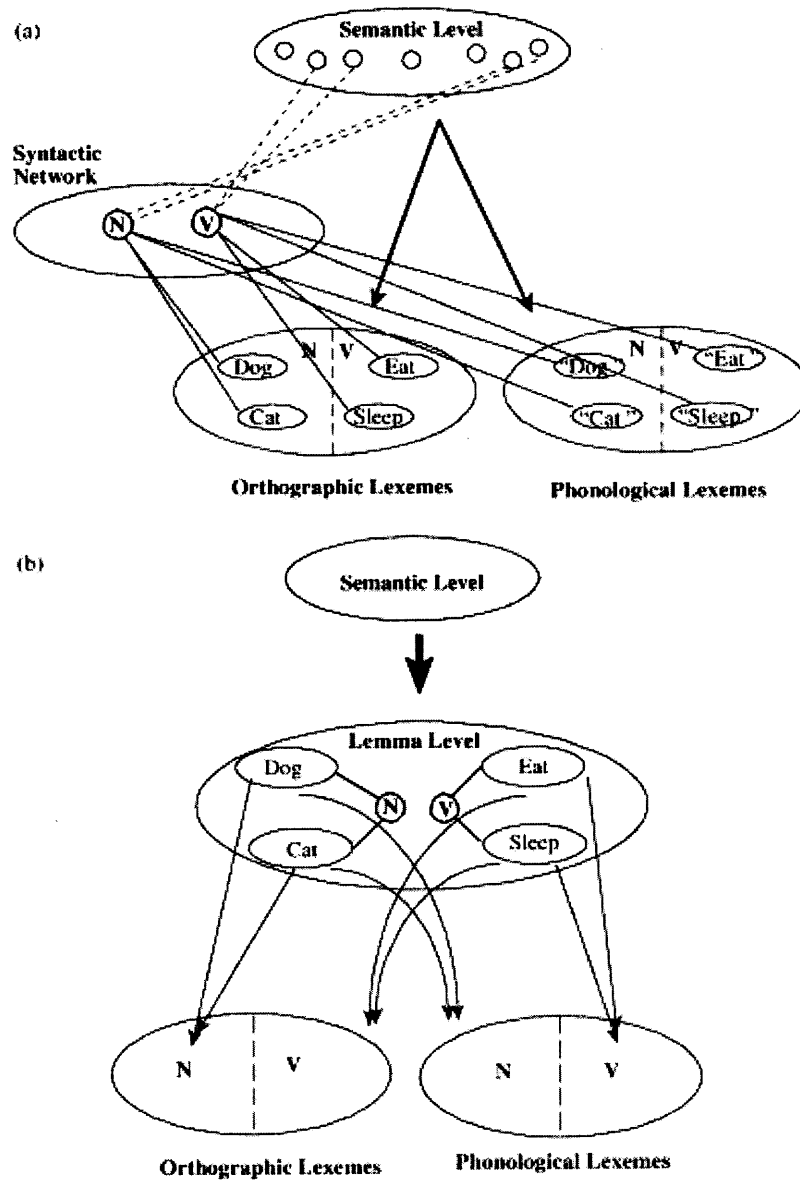


Figure 1: Schematic representation of the Independent Network (IN) theory of Caramazza (1997) with modifications to account for Modality and Grammatical Category Specific Deficits (M&GCSDs), (b) Schematic representation of the Levelt et al. (1999) theory of spoken word production with modifications to account for M&GCSDs). (Figure reproduced from Rapp & Caramazza, 2002, p. 397).

#### **1.4 Summation hypotheses**

Given that the participant in this study has an impaired phoneme-grapheme conversion route and is considered to have difficulty with lexical selection (see Section 2.2) it seems appropriate to consider theories relating to the possible interaction or 'summation' of semantic and phonological/orthographic information in lexical selection. Hillis and Caramazza (1991) point out that impairment to the semantic system and to grapheme-phoneme conversion procedures are not necessarily absolute. They propose that partially available semantic information (e.g. from visual processing of a picture) and partially available phonological information might interact in the output lexicon, enabling the correct lexical item to be retrieved (without a direct link between lexical representations). When conversion procedures are working, activation of phonological information relating to a word will have an impact on the activation of orthographic information for that word. Alario et al (2003) discuss possible mechanisms for this process.

In line with this theory, a subject who is asked to provide a written response in addition to a spoken response in picture naming ('multiple picture naming') should give consistent responses assuming that his or her conversion procedures are intact. However, a subject whose conversion procedures are impaired would be predicted to give lexically inconsistent responses, e.g. spoken response 'moustache' but written response 'beard' for a picture of one of these. This is supported by the finding of several researchers (see Alario et al., 2003) that patients who have phoneme-grapheme conversion difficulties (or vice-versa), in addition to impairment at the semantic and/or lexical level of processing, produce lexically inconsistent responses in 'multiple picture naming'. These lexically inconsistent responses are interpreted by the summation hypothesis to arise as a result of lexical selection being carried out independently for each output modality without the influence of phoneme-grapheme (or vice-versa) conversion procedures. This interpretation therefore suggests that conversion procedures can affect lexical selection.

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In summary, the summation hypothesis postulates that the activation of lexical units is made on the basis of both semantic information and phonological or orthographic information. This introduces the idea that information is transmitted between levels of processing. Hillis and Caramazza (1995) report evidence consistent with the hypothesis in a study of three patients with better oral reading than expected from their profiles. The summation hypothesis has been proposed to account for patients' reading abilities, but it could also account for the summation of semantic information with phonological and/or orthographic information in activating lexical items for writing.

Finally, the author agrees with Marshall, Chiat, Robson and Pring (1996) that "dissociations are less informative about the *functional* consequences of particular processing impairments and skills. Here, a 'theoretically motivated' search for associations may be useful." (p. 258). It seems sensible to aim for a 'search for associations' within a particular patient's profile as well as what is dissociated within that profile; the summation hypothesis mentioned above is a good example of this.

## **2. Methodology**

The data analysed in this study already existed when the study began. The original intention was to do more testing – a more careful comparison of nouns and verbs in the written and spoken modalities – once the existing data had been carefully analysed. Unfortunately, however, the participant suffered a second stroke in December 2004 and was unable to attend the clinic, therefore further data collection was not possible. All of the following information was gathered from the participant's clinical file and from previous studies in which he had taken part.

### **2.1 Participant**

KB, a 58 year old right-handed man, suffered a left-hemisphere cerebrovascular accident in 2001. Before his stroke he was a journalist, working mainly in radio. His work included documentaries, interviews, arts and science programmes. He was also working on a play just prior to his stroke. English is his first language but he also knew French, German, Latin and Greek. Following KB's stroke, he had aphasia and mild dysarthria. He received speech and language therapy on an outpatient basis, and was diagnosed as having a mild to moderate anomic aphasia a year post stroke, as a result of his score on the Western Aphasia Battery (aphasia quotient 88.8; Kertesz, 1982). His spoken language is relatively fluent with some hesitations and perseverations associated with word-finding difficulties, and his comprehension is relatively well preserved. Despite his mild dysarthria, his speech is completely intelligible. In contrast to his spoken output, KB has significant difficulties in written expression, producing semantically and syntactically incomplete written utterances, often omitting verbs. KB has attended an acquired communication disorders clinic since September 2002.

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### 2.2 Psycholinguistic profile

#### Non-verbal tasks (picture only)

KB is good at accessing conceptual and/or semantic information from object pictures, as evidenced by his perfect score (30/30, 100%) on a subset of the picture version of the Pyramids and Palm Trees Test (Howard & Patterson, 1992). He could access conceptual and/or semantic information less well from action pictures; on a computerised version of the Event Perception Test (EPT) (Marshall, Chiat & Pring, 1999) KB scored 53/60 (88%) with no verb label provided for the target picture, and 55/60 (92%) when a verb label was provided (Edwards, 2004). All of KB's errors on both versions of the EPT involved semantically related distractor pictures (close semantic 7/12; distant semantic 5/12), never a gross distractor. These results indicate that KB is able to correctly access semantic representations from pictures, but that (with actions/events especially) there may be difficulties in selecting appropriately from several semantically related representations.

#### Spoken Language – Input

KB's auditory input processing of language is fairly well preserved; evidence for this comes from several sources, not least the finding that he is able and relevant *asked and* in conversation. On a sentence repetition task KB repeated 73% (43/59) of the 7-8 word sentences correctly, with errors being semantic substitutions primarily, indicating his ability to recognise and reproduce auditory input fairly well. He has very good comprehension of spoken sentences, performing within control ranges on the Reversible Sentence Comprehension Test (Byng & Black, 1999). This test involves matching spoken sentences to a pictured scene from a choice of three pictures (target, reverse role distractor, lexical distractor). KB scored 100% (20/20) on action verb sets, and 90% (18/20) on non-action verb sets (Hughson, 2004). His success at this task also suggests he is able to access the meaning and thematic structure of verbs from a spoken form. Additional evidence for good spoken sentence comprehension comes from the 'Listening Recall' subset of a

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memory battery (Pickering & Gathercole, 2001) in which KB had to listen to sentences and judge them as true/false, which he did correctly (6/6).

### **Spoken Language – Output**

On a spoken naming task on 20 nouns and 20 verbs selected from An Object and Action Naming Battery (Druks & Masterson, 2000) which were matched for imageability and frequency, KB scored 16/20 (80%) for both objects and actions, with similar error types for both: 7 out of these 8 errors were semantically related to the target. This demonstrates a mild word finding difficulty for both nouns and verbs in the spoken modality, and the possibility of problems in semantic selection and/or activating phonological forms from semantics.

In sentence production tasks and in conversation, these proposed problems in semantic selection and/or activation of phonological forms were again evident. KB's spoken picture descriptions (and his spontaneous spoken output) showed semantic substitutions, circumlocutions, brief inappropriate pauses and perseverations. These difficulties affected all major lexical categories and function words (Bendre, 2004), which indicates that there is no specific verb problem in spoken output. Despite these setbacks, KB conveyed adequate semantic information and was semantically relevant in his spoken language production.

### **Written language – input (reading)**

KB could read silently for meaning very well, which suggests that he could process the visual orthographic input and that his semantic system was working adequately. He was able to match single written words to pictures (PALPA; Kay et al. 1992: Subtest 48) with 100% accuracy (40/40), answer questions about a written sentence, and give an oral summary of short story. On the Reading Comprehension Battery for Aphasia (La Pointe & Horner, 1979), KB scored 90% (90/100), indicating relatively well preserved silent reading skills, although he found the tasks effortful. Reading numbers, understanding morphosyntactic



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distinctions and understanding specific contents of written paragraphs were the difficulties KB encountered in this test.

In contrast to relatively good silent reading, KB experienced difficulties reading aloud. In oral reading of single words, KB made some errors, particularly for low imageability items (PALPA; Kay et al. 1992: Subtest 31, 70/80, 88%). In reading sentences aloud, KB made omission and substitution errors, including semantic, morphological, and function word errors.

### **Written language – writing to dictation**

Previous assessment had identified impairment of KB's phoneme-grapheme conversion system, and therapy aimed to strengthen his sublexical spelling route had no effect on his ability to convert phonemes to graphemes directly (Bendre, 2004). Single word writing to dictation was very poor for KB. In writing to dictation single words from the Millard word list (Millard, 1998) KB scored only 28% (40/144) correct. The items were of varied frequency and length, and there was no significant association of word frequency or length with correct realisations (Bendré, 2004). Additionally, KB could write nouns to dictation better than verbs to dictation. When writing to dictation a subset of nouns and verbs from An Object and Action Naming Battery (Druks & Masterson, 2000), KB wrote 12/15 (80%) nouns correctly in contrast to just 2/15 (13%) verbs, indicating a clear verb deficit in writing to dictation ( $\chi^2=13.39$ ,  $df=1$ ,  $p<0.001$ ). This had not been observed in the spoken modality (whether in spoken naming, spontaneous output or picture description). However, in writing to dictation scene descriptions based on his spoken output (Bendre, 2004), there was also a significant category-related effect in favour of nouns over verbs. Part of this was due to different error types for nouns and verbs: KB tended to substitute rather than omit nouns, but to omit rather than substitute verbs.

### **Summary**

KB's psycholinguistic profile shows that he does not have a semantic problem although he has some difficulty with selection. There is some difficulty in the

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transmission of activation between semantics and form, especially semantics to orthographic forms, which may or may not be related to the semantic selection problem. There are grapheme-phoneme conversion problems and probably some graphemic output buffer problems, hence his poor performance on the Millard writing to dictation task.

### **2.3 Procedure – Data Collection**

The data analysed for this study was mainly collected in a previous study (Bendre, 2004) and some further data was available from KB's clinical file. The data was collected between November 2002 and March 2004, between 19 months and nearly 3 years post KB's stroke. This study analyses KB's semantic, phonological/orthographic and mixed substitution errors for verbs; syntactic category substitutions; and verb omission errors. A separate study (Kidger, 2005) analyses KB's verb morphology.

In Bendre's study, KB was asked to write narrative descriptions of three pictures: 'The Cat' (Swinburn, Porter, & Howard, 2004), 'The Robbery' (Evans, 1987) and 'The Dinner Party'. 'The Cat' and 'The Robbery' were both composite pictures, depicting different states and events; 'The Dinner Party' was an 8-picture cartoon strip that provided more detailed semantic information about specific events (see Appendix 1). Bendre also recorded and transcribed KB's spoken descriptions of these three pictures, then used KB's spoken output to form the basis of dictation targets for each of the pictures. This ensured that the target vocabulary used in writing to dictation was in his lexicon. The same dictation target was used for all writing to dictation tasks for a particular picture, and usually the picture was present during the dictation task. Between February 2003 and February 2004, KB completed two spoken and two written descriptions for each of 'The Cat', 'The Robbery' and 'The Dinner Party'; three writing to dictation tasks for 'The Cat' and 'The Robbery'; and four writing to dictation tasks for 'The Dinner Party'. Data collection was thus well spaced out across the year. These data allow for direct comparisons between spoken and written output elicited by the same material. They form the bulk of the data analysed in this study (see Appendix 2).

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Two other pairs of identical tasks were identified from KB's clinical file: a written and spoken description of another picture sequence, 'The Jogging Cartoon' (Appendices 3 & 4), and written and spoken versions of a procedural task, describing how to make coffee (Appendix 5). In both cases the spoken data was recorded and transcribed.

As the coffee making descriptions were procedural and did not involve pictures, they were listed separately in Table 1 of the Results section 3.1. However, since data from the procedural task was very similar to the picture description data, the two types of sample were combined in later tables.

### **2.4 Procedure – Data Analysis**

#### **2.4.1 Utterance analysis in spoken and written tasks**

Spoken samples were prepared for analysis by excluding the following:

- Automatic speech, e.g. "*you see*"
- Comments on what he had just said, e.g. "*I don't like ties very much*"
- Repetitions of the same idea or same words, e.g. "some... *um...* paper *some some*"
- When he self-corrected, his mistake was excluded, e.g. "*the his little chair sorry* the table".

(The excluded speech is in *italics* both here and in the Appendices).

Spoken utterances were identified by way of subject maintenance in a consistent manner across all spoken tasks. Sometimes two previously separate utterances into were combined into one if it was considered to be more appropriate (original breaks denoted by //):

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The Cat, 7.1.04:

Line 3: and on the top shelf there's a cat and some books // and a um um  
um a /f/ plant //

In all written tasks, break up of utterances was denoted by the way KB set his writing out on the page. Crossed out words were not analysed, but are included for interest (see Appendices), as errors that KB made and was aware of.

The number of utterances in each task were counted and then compared with Kidger's (2005) and Bendre's (2004) counts.

### **2.4.2 Well-formed vs. ill-formed utterances**

Utterances were classified as either semantically and syntactically well or ill formed. Ill-formed utterances were those that violated syntactic rules or did not make sense semantically, e.g.

The Cat, spoken, 7.1.04:

Line 4: in the next shelf as some yeah as some a goldfish

Written utterances were often classed as ill formed due to omission of a suitable verb, e.g.

The Robbery, written, 8.1.04:

Line 4: The thieves, their caps, his the spanner.

However, the lack of a verb did not always class an utterance as ill formed. The following is a perfectly good description despite not containing a verb:

The Cat, 8.1.04:

Line 1: A living room.

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### 2.4.3 Error types identified (see Tables 1-4 in Sections 3.2 and 3.4)

Verbs in the data were identified, and percentages were calculated for proportion correct and incorrect. In spoken and written picture descriptions, possible 'target' verbs were worked out on the basis of the semantic information in the pictures. Verbs were counted as correct if they could plausibly be used to describe what was in the picture, even if they were a 'light' verb substitution for a more specific verb (e.g. 'get' used for 'catch'). Verb omissions (in written output only) were identified where the utterance was ungrammatical without a verb. (The possible target verbs are listed in brackets):

'The Dinner Party' 27.2.03:

Line 8: The man **is** fish & chips

OMISSION of main verb (e.g. 'buying', 'getting') as depicted by the picture

Sometimes it wasn't possible to establish what the intended verb was, therefore possible targets are marked as 'other verb' in the results tables.

In writing to dictation, the target verbs and structures were known and could be directly compared to KB's output, which made classifying verb errors more definite (see Appendix 2).

Verb substitution errors were counted as:

- Semantic – if they were related in meaning to the assumed target verb, but were not completely semantically appropriate to the context, e.g. *eaten* → '*licked*'
- Phonological and/or orthographic - if there was relevant phonological or orthographic similarity to the target, e.g. *rest* → '*left*'
- Mixed - if they were related in meaning and phonology/orthography to the assumed target verb, e.g. *tripped over* → '*toppled*'

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- Syntactic category error – if the assumed target word had been substituted by a word of a different syntactic category, with either the target or the substitution being a verb, e.g. adjective *asleep* → verb ‘*sleep*’
- Unknown type – if their origin was unclear

Some decisions were made depending on the greater orthographical or phonological similarity to the assumed target verb. For the written example *rest* → ‘*left*’, the phonological similarity between the target and substitution is greater than their orthographic similarity. Orthographically, the two words only have letters ‘e’ and ‘t’ in common. Phonologically, however, all four phonemes correspond with each other: /r/ and /l/ are both approximants, /s/ and /f/ both fricatives, the letter ‘e’ corresponds to the vowel /e/ in both of these words, and the letter ‘t’ corresponds to the same phoneme in each word.

### **2.4.4 Phrasal substitutions writing to dictation tasks**

A number of KB’s utterances were classified as being a ‘phrasal substitution’ (see Box 1, Section 3.5), whereby KB had substituted a whole phrase rather than a single verb, often semantically related to the target utterance, e.g.

Target Line 2: His father’s *having* a snooze in the armchair.

KB: The father *is sleeping* arise in armchair.

---

## *Results*

### **3. Results**

#### **3.1 Is there a difference between spoken and written verb production?**

KB's spoken and written output for 4 different picture descriptions were compared in order to identify the difference between his spoken and written verb production (see Methodology, Section 2.3).

In spoken tasks, KB produced on average 16 utterances per task, of which nearly all were syntactically and semantically well formed (mean 96%), and nearly all utterances contained verbs (mean 96%). Of the utterances that did not contain any verbs, 100% were still grammatically correct without a verb. In written tasks, KB produced on average 9 utterances per task, of which less than half were syntactically and semantically well formed (mean 40%). Less than half of the utterances contained verbs (mean 41%). Of those utterances that did not contain any verbs, only 34.5% of them were grammatical without a verb.

On these identical tasks, KB's verb production was different for the spoken and written versions. In the spoken versions, he produced main verbs correctly almost all of the time on most occasions (mean 96% of verbs correct over 7 spoken tasks; range: 92% - 100%). The relatively small percentage (0% - 8%) of errors in his spoken verb production always involved substitution errors rather than omission errors. Additionally, KB's production of auxiliary verbs was 100% accurate in all of these 7 spoken tasks.

In the written versions of the same picture descriptions, KB produced on average less than a third of the main verbs correctly (mean 28% of verbs correct over 7 written tasks; range: 12.5% - 50%). Therefore, the percentage of verb errors ranged from 50% - 87.5% in written tasks.

Taking all 7 written tasks together, verb omission errors appear to be the most common type of error (44.5% mean verb omissions across tasks) followed by verb substitution errors (27.5% mean verb substitutions across tasks, including

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morphological substitution errors). These error types will be discussed in more detail below (see Table 1).

From these summary percentages it is clear that KB does perform differently in spoken and written versions of comparable tasks. He produces main verbs accurately most of the time in his spoken picture descriptions (mean: 96%) while only some of the time in his written descriptions (mean: 28%) of the same pictures.

The difference in written and spoken performance is not only evident when KB is describing a picture; it is also evident in a procedural task using KB's own self-generated description of "how to make coffee". His spoken and written descriptions of how to make coffee are extremely similar to his picture descriptions in terms of the number of utterances produced and number of main verbs and auxiliary verbs produced correctly. Therefore we can postulate that the modality-specific difference in verb production seems to apply to any kind of spoken versus written task, not just picture description.



## Results

Table 1: percentage of correct verb production in the two modalities.

	<b>Written modality</b>	<b>Spoken modality</b>
<b>Main verbs correct in picture descriptions</b>	Cat 3.7.03: <b>14% (1/7)</b> Cat 8.1.04: <b>12.5% (1/8)</b> Robbery 3.7.03: <b>33.3% (1/3)</b> Robbery 8.1.04: <b>50% (3/6)</b> Dinner Party 27.2.03: <b>22.2% (2/9)</b> Dinner Party 8.1.04: <b>24% (4/17)</b> Jogging 21.11.02: <b>40% (4/10)</b>  <b>Mean 28% main verbs correct per task, over 7 tasks.</b>	Cat 1.7.03: <b>100% (20/20)</b> Cat 7.1.04: <b>100% (16/16)</b> Robbery 1.7.03: <b>96% (26/27)</b> Robbery 7.1.04: <b>93% (27/29)</b> Dinner Party 13.3.03: <b>96% (26/27)</b> Dinner Party 7.1.04: <b>94.7% (36/38)</b> Jogging 28.11.02: <b>92% (23/25)</b>  <b>Mean 96% main verbs correct per task, over 7 tasks.</b>
<b>Main verbs correct in procedural task</b>	Coffee 27.2.03: <b>33.3% (1/3)</b>	Coffee 13.3.03: <b>100% (22/22)</b>
<b>Auxiliary verbs correct in picture descriptions</b>	Robbery 8.1.04: <b>0% (0/1)</b> Dinner Party 27.2.03: <b>75% (3/4)</b> Dinner Party 8.1.04: <b>50% (1/2)</b> Jogging 21.11.02: <b>0% (0/1)</b>  N.B. in the other 3 written picture description tasks, no auxiliary verbs were produced or needed.  <b>Mean 31% auxiliary verbs correct per task, over these 4 tasks only.</b>	Cat 1.7.03: <b>100% (7/7)</b> Cat 7.1.04: <b>100% (5/5)</b> Robbery 1.7.03: <b>100% (12/12)</b> Robbery 7.1.04: <b>100% (11/11)</b> Dinner Party 13.3.03: <b>100% (10/10)</b> Dinner Party 7.1.04: <b>100% (17/17)</b> Jogging 28.11.02: <b>100% (2/2)</b>  <b>Mean 100% auxiliary verbs correct per task, over 7 tasks.</b>
<b>Auxiliary verbs correct in procedural task</b>	Coffee 27.2.03: no auxiliary verbs produced.	Coffee 13.3.03: <b>100% (11/11)</b>

### 3.2 Error types

As discussed in Section 3.1, KB made some substitution errors but never omitted any verbs during his spoken output, while he made more verb omission errors than substitution errors in his written output. In order to analyse this difference in

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error types more clearly, Table 2 below shows the breakdown of verb omission errors versus verb substitution errors.

The main difference between the spoken and written tasks in terms of errors is the high percentage of main verb omissions in written tasks (mean 47% over 8 tasks, range: 10% - 66.7%) in contrast to no verb omissions at all in spoken tasks. The same pattern held true for auxiliary verb omissions (mean 31% over 8 written tasks, range: 0% - 100%, and no Aux omissions in spoken tasks).

Examples of some verb omissions from KB's written output are:

\*The a cup on the table (From 'The Cat' written output 3.7.03)

\*the old woman beside bus stop. (From 'The Robbery' written output 3.7.03)

\*The women and two man            food. (From 'The Dinner Party' written output 27.2.03)

For two of these sentences, it is assumed that main verb 'be' has been omitted. For the third example, it is assumed that a form of the verb 'eat' has been omitted ('eat' or 'are eating'). KB's awareness of this verb omission is suggested by the space he left.

An interesting pattern in KB's main verb omissions is that 27% (7/26) are omissions of main verb 'be' (is, are, etc.), and a further 19% (5/26) are omissions of either 'be' or another verb (as specified in Table 2). Therefore it seems that 'be' is a particularly problematic main verb for KB to produce in written output.

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Table 2: Verb omission errors vs. verb substitution errors in the two modalities.

Error Type	Written modality	Spoken modality
<p><b>Omission errors - main verb</b></p>	<p>Jogging 21.11.02: <b>10% (1/10)</b> ['are']            Cat 3.7.03: <b>43% (3/7)</b> ['is', 'is', be/sleep/other V]            Cat 8.1.04: <b>62.5% (5/8)</b> ['is', are/other V, are/rest/other V, other V, other V]            Robbery 3.7.03: <b>66.7% (2/3)</b> ['is', other V]            Robbery 8.1.04: <b>50% (3/6)</b> [other V, other V, 'is'/'is waiting']            Dinner Party 27.2.03: <b>44.4% (4/9)</b> ['set', 'eat', 'buying'/'getting', other V]            Dinner Party 8.1.04: <b>35% (6/17)</b> ['are', 'go', 'is', 'got', 'are'/'go', other V]            Coffee 27.2.03: <b>66.7% (2/3)</b> ['put'/'other V, 'leave'/'put']</p> <p><b>Mean 47% omission errors per task, over 8 tasks</b> (total 26 main verb omissions over 8 tasks, or mean 3.25 omissions per task)</p>	<p>There were no main verb omission errors in any of the 8 spoken tasks.</p> <p>Therefore, <b>mean 0% omission errors per task, over 8 tasks</b></p>
<p><b>Substitution errors - main verb</b>            (Excluding morphological substitution errors)</p>	<p>Jogging 21.11.02: <b>10% (1/10)</b> [tripped over → 'toppled']            Cat 3.7.03: <b>14% (1/7)</b>: [rest → 'left']            Cat 8.1.04: <b>25% (2/8)</b> [catches/gets → 'put']; [A asleep → V 'sleep']</p> <p><b>Mean 6% substitution errors per task, over 8 tasks</b> (total 4 main verb substitutions over 8 tasks)</p>	<p>Jogging 28.11.02: <b>8% (2/25)</b> [trips → 'slips']; [is/goes/gets/arrives → 'was']            Robbery 1.7.03: <b>4% (1/27)</b> [shouting/screaming/calling after → 'saying', 'chatting']            Robbery 7.1.04: <b>7% (2/29)</b> [screaming → 'streaming']; [saying → 'staying']            Dinner Party 7.1.04: <b>3% (1/38)</b> [eaten → 'licked']</p> <p><b>Mean 3% substitution errors per task, over 8 tasks</b> (total 6 main verb substitutions over 8 tasks)</p>

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Error Type	Written modality	Spoken modality
<b>Omission of auxiliary verb</b>	Jogging 21.11.02: <b>100% (1/1)</b> ['are'] Robbery 8.1.04: <b>100% (1/1)</b> ['are'/'were'] Dinner Party 8.1.04: <b>50% (1/2)</b> ['has']  <b>Mean 31% omissions of auxiliary verbs over 8 tasks (total 3)</b>	There were no omissions of auxiliary verbs in any of the 8 tasks; all necessary auxiliary verbs were included.  <b>Mean 0% omissions of auxiliary verbs over 8 tasks</b>
<b>Substitution of auxiliary verb</b>	There were no auxiliary verb substitutions noted in any of the 8 written tasks; there were only <b>8</b> necessary auxiliary verbs, 3 of which were omitted (above), 4 of which were used correctly, and 1 of which was morphologically incorrect.  <b>Mean % substitutions of auxiliary verbs (excluding morphological) over 8 tasks: 0% (mean 1 Aux produced per task)</b>	A total of <b>74</b> auxiliary verbs were used in the 8 spoken tasks, and all were used correctly.  <b>Mean % substitutions of auxiliary verbs over 8 tasks: 0% (mean 9 Auxs produced per task)</b>

Substitution errors were categorised as semantic, phonological/orthographic, syntactic category errors, or those of unknown type. Table 3 below details the substitution errors in both modalities.

There are very similar numbers of the various substitution errors in both spoken and written modalities, indicating that some processing difficulties may be common to both modalities.

The fact that a small amount of semantic substitutions are being made in both modalities suggests that there may be a mild selection problem at a semantic or post-semantic level of processing, whereby the conceptual processing of what is in the picture activates several verbs, but the most appropriate verb is not always selected. Evidence for this comes from instances where KB produces more than one verb at the same time, to express the same event:

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From 'The Jogging Cartoon' written output 21.11.02 (target assumed to be 'tripped over')

Line 5: The man *toppled* a dog accross (*sic.*) the ~~path~~ kerstone.

Line 6: The man *fall* accross the path under the dog.

From 'The Robbery' spoken output 1.7.03 (target: 'shouting'/'calling after'):

"And then on top of that there's a man at the post office and *he's saying he's chatting* to two robbers."

From 'The Cat' written output 3.7.03:

...his he *catch up got* a the goldfish on bowl

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Further evidence for a selection problem semantically or post-semantically is the small amount of 'light verb' substitutions KB makes in spoken tasks. These are not counted as substitution errors, but the verbs produced are not the most specific ones for the target meaning. Examples are: *cook/prepare* → 'do'; *hide* → 'do'; *repair/sell* → 'do'; *catch* → 'get'; *steal/rob* → 'get'; *drink* → 'have'; *contain* → 'have'.

The small amount of orthographic substitution errors in writing and phonological substitution errors in spoken output suggest that the assembly and/or motor execution of the appropriate graphemes or phonemes for a given activated verb may not be entirely intact. If we assume a model that allows for feed back as well as feed forward of information, it might also be possible that the incomplete orthographic or phonological information feeds back into selecting a different word that is semantically related (as well as orthographically or phonologically related). So, for the previous example *tripped over* → '*toppled*', the incomplete orthographic information for the spelling of 'tripped' might have fed back into selecting 'toppled' as it starts with a 't', has double 'pp' in its centre, and the ending 'ed', and furthermore it is semantically related. The same could be said

what model do you have in mind?

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for the spoken example *trips* → '*slips*', except that the phonology would be implicated rather than the orthography.

Additionally it could be that the phonology of a word is implicated for written orthographic substitution errors. The written example, *rest* → '*left*' illustrates this possibility. The phonological similarity between these two words is striking, compared to only partial orthographic similarity (see Section 2.4.3). There is only some semantic similarity between the assumed target 'his feet *rest* on a table' and the produced sentence, "His feet *left* on a table", therefore it is reasonable to suggest that the phonology of 'rest' contributed more than its meaning did to its realisation as 'left'. This indicates the possibility of a *summation* of phonological and semantic information in selecting a candidate verb to be produced (see Section 4.2)

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Table 3: Substitution error types (main verbs only) in both modalities.

Type of substitution error (main verbs only)	Written modality	Spoken modality
Semantic	Jogging 21.11.02: <b>10% (1/10)</b> [tripped over → 'toppled'] <i>Also possible orthographic aspect to this!</i>  Cat 8.1.04: <b>12.5% (1/8)</b> [catches/gets → 'put']	Jogging 28.11.02: <b>4% (1/25)</b> [trips → 'slips'] <i>N.B. also could be counted as a phonological error</i>  Robbery 1.7.03: <b>4% (1/27)</b> [shouting/screaming/calling after → 'saying', 'chatting']  Dinner Party 7.1.04: <b>3% (1/38)</b> [eaten → 'licked']
Phonological or Orthographic	Jogging 21.11.02: <b>10% (1/10)</b> [tripped over → 'toppled'] <i>Counted as a semantic error but there are orthographic elements.</i>  Cat 3.7.03: <b>14% (1/7)</b> [rest → 'left']	Jogging 28.11.02: <b>4% (1/25)</b> [trips → 'slips'] <i>N.B. also could be counted as a semantic error</i>  Robbery 7.1.04: <b>3.4% (1/29)</b> [screaming → 'streaming']  Robbery 7.1.04: <b>3.4% (1/29)</b> [saying → 'staying']
Mixed phonological/ orthographic & semantic??	Jogging 21.11.02: <b>10% (1/10)</b> [tripped over → 'toppled'] <i>Counted as a semantic error but also phonological similarity.</i>	Jogging 28.11.02: <b>4% (1/25)</b> [trips → 'slips']
Syntactic category error	Cat 8.1.04: <b>12.5% (1/8)</b> [A asleep → V 'sleep'] <i>N.B. could be orthographic error too – missing off the letter 'a'.</i>	
Substitution error of unknown type		Jogging 28.11.02: <b>4% (1/25)</b> [is/goes/gets/arrives → 'was'] <i>If assumed to be [is→'was'], this would be a morphological error and would not be discussed in this account.</i>

N.B. If a task is not mentioned, it means there were no substitution errors in that task.

### 3.3 Spoken Input to Written Output: Writing to Dictation results

For three of the picture descriptions, 'The Cat', 'The Robbery', and 'The Dinner Party', KB was given writing to dictation tasks in addition to spoken and written description tasks. As described in Section 2.3, the same spoken target for a

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particular picture was used each time. Table 4 below shows a detailed breakdown of results.

The syntactic structure of verb phrases was broadly preserved from the spoken input to the written output, even where the verb was omitted, or was incorrect, and other syntactic categories such as prepositions were omitted, e.g.

Dinner Party, 14.1.04:

Target Line 6: They *go* to their bedroom and they *put* on their clothes.

NP[N] VP[V PP[P NP]] and NP[N] VP[V PP[P NP]]

KB: They *were* a bedroom and they \_\_\_\_\_ their dresses.

NP[N] VP[V NP] and NP[N] VP[*omitted* V NP]

In writing to dictation tasks, KB produces target main verbs correctly only 6.5% of the time, compared to 28.7% of the time in the spontaneous written picture descriptions. His correct production of auxiliary verbs is comparable between the writing to dictation and written description tasks (20% and 18% respectively). Therefore KB seems to find it more difficult to preserve and write a main verb correctly from spoken input (dictation) than to write a main verb correctly from his own conceptualisation of a picture, while his auxiliary verb production does not differ between these two types of task. However, inspection of the morphological substitutions KB produced in writing to dictation tasks reveals that 63% (12/19) of them were used appropriately in the utterance produced, despite differing morphologically from the target, e.g.

Dinner Party 14.1.04

Target Line 1: "The husband *phones* a friend."

KB: A husband *telephoned* of couple.

Main verb omission errors are the most common type of error in writing to dictation tasks (mean 46.2% over 10 tasks) followed by substitution errors (mean 34% over 10 tasks, including morphological substitutions). This is highly



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comparable to the proportions of omission errors (44.5%) and substitution errors (27.5%, including morphological) in written tasks (see Section 3.1), indicating that similar processing might be occurring.

### 3.4 Error Types in Writing to Dictation

KB's rate of main verbs omissions is comparable between writing to dictation and written output: 46.2% and 44.5% respectively. His rate of auxiliary verb omissions is higher in the writing to dictation tasks (50%) than in the written description tasks (31%). Examples of some main and auxiliary verb omissions from KB's writing to dictation are:

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(Robbery 22.1.04)

Line 2: "One *is* a post office and there's a shoe shop and a newsagents."

KB: A post office\_\_ and the a ð ð shoe repair a newsagent.

(Cat 5.2.04)

Line 3: "He's *got* his feet on the table."

KB: His † feet across the table.

(Dinner Party 3.7.03)

Line 4: "He's *washing* the dishes and she's *cooking*."

KB: The man *washes* a dishes; the woman \_\_\_\_ meal.

KB's above utterances show omissions of main verbs 'be', 'get' and 'cook', and omissions of auxiliary verbs 'have' and 'be'. KB often indicates his awareness of an omission by leaving a space or underlining where the verb should be (as done in two of the above examples and an example from written output in Section 3.2). By doing this he is showing that he knows that syntactically and semantically there should be a verb in his written output or writing to dictation. Similarly, his mainly correct use of verbs in spoken output shows that he knows there should be verbs, and he knows how to use them, semantically and

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syntactically. Therefore we can infer that he has access to verb semantics and basic sentence structure syntax.

In Section 3.2 it was mentioned that omissions of main verb 'be' accounted for at least 27% (7/26) of main verb omissions in written output. Interestingly, in writing to dictation tasks, omissions of main verb 'be' account for 51% (30/59) – over half - of the main verb omissions, and are therefore nearly twice as prevalent as in written output. This figure could be artificially inflated, however: omissions are identified more readily in writing to dictation tasks where there is an obvious target verb. Nonetheless, it is further evidence that main verb 'be' is particularly problematic for KB to produce in writing.

KB's rate of main verb substitutions is much higher in writing to dictation tasks than in written description tasks, with target main verbs being substituted 22.5% on average in writing to dictation, compared to only 6% in written description. (morphological substitutions have been excluded from these figures).

Substitution errors were categorised as semantic, phonological/orthographic, mixed semantic & phonological/orthographic, syntactic category errors, and substitution errors of unknown type.

Semantic substitutions were the most common substitution type produced after morphological substitutions (which are discussed by Kidger, 2005). On average, 11.1% of target main verbs were produced as semantic substitutions, and these were not necessarily errors despite not matching the target verb. The majority (67%, 10/15) of main verb semantic substitutions were used appropriately in the utterance produced; the other 33% (5/15) were semantic errors. The following examples illustrate the same target main verb in each task, giving rise to both a semantically appropriate substitution and an erroneous one:

Robbery

Target Line 3: "There's a man *talking* to two robbers."

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KB 14.1.04: The outside man *say* a couple thieves. =error

KB 22.1.04: A ðe young man *calls* † a young thieves. =used appropriately

### Dinner Party

Target Line 12: "Then they *sit* down in the dining room..."

KB 4.2.04: They *seat* in the dining room... =error

KB 29.4.04: They *are waiting* in dining room... =used appropriately

Together with semantically related phrasal substitutions (discussed below in Section 3.5), these semantic substitutions for target main verbs indicate that KB is using a lexical route in writing to dictation, and that there are some problems in selecting from a number of activated semantically related candidate verbs.

As in the case of the error *rest* → '*left*' discussed in Section 3.2, KB makes an error in writing to dictation which seems to implicate the phonology as well as the orthography of the target word in its selection: *trying* → '*driving*'. KB underlined '*driving*' to indicate his awareness that it was incorrect. Orthographically, the two words only have the ending '-ing' in common. However, if the two words are phonetically transcribed, the importance of their common phonology becomes clearer: /t r aɪ ɪ ŋ/ → [d r aɪ v ɪ ŋ]. Both have the same vowel /aɪ/ in the middle of the word and the same ending /ɪŋ/. Both begin with alveolar plosives, /t/ and /d/, the only difference between these being that /t/ is unvoiced while /d/ is voiced, and both have the approximant /ɹ/ after the plosive. There is no semantic similarity between 'trying' and 'driving', therefore the selection of 'driving' must logically be due to the extremely similar phonology of the target, 'trying'.

Some other errors seem to implicate both semantics and form in their selection. For *set* → '*playst*', a semantic substitution seems to have occurred from 'set' to 'placed' (both verbs can describe putting cutlery on the table) and the phonology of the verb seems to have influenced its orthographic realisation. For *set* → '*settle*', the meaning and form of 'set' seem to have jointly influenced the

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selection of 'settle'. For *shake* → '*clip*', it is possible that 'shake hands' triggered activation of verbs that are semantically related to hands such as 'clap' or 'clasp', and 'clip' seems to be an orthographic or phonological substitution for 'clap'. As mentioned in Section 3.2, these error types indicate the possibility of a *summation* of phonological/orthographic and semantic information in selecting a candidate verb to be produced.

Substitution errors of unknown type were also a fairly large category of errors after semantic substitutions, comprising 8.3% of target main verbs on average. Substitutions of main verb 'go' made up the majority of these errors (62%, 8/13); followed by 23% (3/13) 'be' substitutions, and 15% (2/13) other verb substitutions ('nick', 'try'). On two occasions, 'be' became a form of 'have', [*be* → 'have']. The main verb 'go' was substituted by several different verbs, most commonly by the verb 'be' (62.5% of the time), as in the following examples:

Dinner Party 14.1.04

Target Line 9: Then they all *go* into the dining room

KB. They simple *were* in the room.

Dinner Party 29.4.04

Target Line 7: They *go* downstairs.

KB: They *are* \_ \_ \_ in

The reverse substitution was also found with 'be' being produced as 'go', as in the following example where 'goes' has been produced for 'are', but then crossed out due to awareness that it was incorrect:

Dinner Party 29.4.04

Target Line 3: The husband and wife *are* in the kitchen.

KB: The ~~h~~ husband the wife and \_\_\_\_\_ ~~goes~~ kitchen.

## Results

Other substitution errors seem to have come about by KB anticipating a verb occurring later in the target utterance, and then perseverating on it:

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Cat 14.1.04

Target Line 6: "The cat's *trying to get* one of them."

KB: The cat *is got* her *got* they their.

Dinner Party

Target Line 6: "They *go* to their bedroom and they *put* on their clothes."

KB 4.2.04: They *put* the bedroom and they've *dressed* \_\_\_\_\_ clothes.

KB 29.4.04: They **is are dressing** the bedroom and they **are dressing** clothes.

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The target verb 'get' is produced twice, knocking off the verb 'try', giving *try* → 'get'. Similarly, the target verb 'put' has been activated/anticipated earlier in the utterance and knocks off the verb 'go', giving *go* → 'put'. It seems that it is not the *form* of the verb in the input, but the *semantic* content of the verb that gives rise to the perseveration. This is a viable explanation for all the instances of perseveration noted. Thus the target VP 'put on their clothes' has given rise to the semantically comparable VP 'are dressing' twice in the produced utterance. This type of error could indicate a deficit in working memory, as there seems to be a 'recency effect' going on, whereby the most recently heard verb is remembered while the earlier verb becomes lost and cannot be accessed.

When KB counts the number of words in the target utterance on his fingers (using so called 'finger memory'), his writing to dictation performance improves slightly; therefore written performance could be considered to result from a problem in working memory, as raised above. However, the fact that KB's spoken repetition is good rules out a central working memory problem as such a deficit would affect repetition and writing to dictation equally (he scored 73% correct on a sentence repetition task outlined in Section 2.2). Further evidence of

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KB's good spoken repetition comes from writing to dictation tasks in which KB repeated the spoken target first. Forty-one (41) sentences were dictated, ranging in length from 4-8 words, with the majority being 5 or 6 words long. KB repeated 100% (41/41) of these completely accurately, but only wrote down 19.5% (8/41) completely accurately to match what he had repeated. This clearly shows that he can remember spoken input perfectly well (as he repeats it accurately), and that his poorer written performance cannot be attributed to problems in holding the spoken input in his working memory. Furthermore, due to his good performance on these tasks we can safely assume that KB would have accurately repeated most of the writing to dictation targets in the data analysed in this study, even though they comprised longer sentences (they ranged in length from 3-18 words long, with the majority being 7, 8, and 9 words long).

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Table 4: Main and auxiliary verb production in all writing to dictation tasks.

Category of result	Writing to Dictation task & details
<p>Target main verbs produced correctly</p> <p>Mean: <b>6.5%</b> correct per task, over 10 tasks (total 11)</p>	<p>Robbery 11.9.03: <b>9% (1/11)</b> [talk]            Robbery 14.1.04: <b>0% (0/11)</b>            Robbery 22.1.04: <b>0% (0/11)</b></p> <p>Cat 11.9.03: <b>0% (0/11)</b>            Cat 14.1.04: <b>0% (0/11)</b>            Cat 5.2.04: <b>0% (0/11)</b></p> <p>Dinner Party 3.7.03: <b>11% (2/18)</b> [go; eat]            Dinner Party 14.1.04: <b>11% (2/18)</b> [sit; eat]            Dinner Party 4.2.04: <b>17% (3/18)</b> [cook; go; eat]            Dinner Party 29.4.04: <b>17% (3/18)</b> [wash; cook; go]</p>
<p>Target main verbs produced with morphological substitutions (used correctly unless indicated as an error)</p> <p>Mean: <b>11.5%</b> morphological substitutions per task, over 10 tasks (total 19; of these 37% (7/19) were errors; 63% (12/19) were used correctly)</p>	<p>Cat 14.1.04: <b>18% (2/11)</b>            [are going → 'go']; [to get → 'her got' <b>error</b>]            Cat 5.2.04: <b>9% (1/11)</b> [are going → 'go']</p> <p>Dinner Party 3.7.03: <b>22% (4/18)</b>            [phones → 'telephoned' (sic)]; [is washing → 'washes'];            [go → 'went']; [sit → 'sits' <b>error</b>]            Dinner Party 14.1.04: <b>22% (4/18)</b>            [phones → telephoned]; [is washing → 'washes'];            [is cooking → 'cook' <b>error</b>]; [goes → 'go' <b>error</b>]            Dinner Party 4.2.04: <b>22% (4/18)</b>            [phones → 'telephoned']; [said → 'says'];            [is washing → 'washes']; [goes → 'go' <b>error</b>]            Dinner Party 29.4.04: <b>22% (4/18)</b>            [phones → 'telephoned']; [go → 'are going'];            [goes → 'go' <b>error</b>]; [eat → 'ate' <b>error</b>]</p>
<p>Target main verbs OMITTED</p> <p>Mean <b>46.2%</b> omitted per task over 10 tasks (total 59)</p> <p>'be' omissions account for 51% (30/59) of the main verb omissions.</p>	<p>Robbery 11.9.03: <b>45% (5/11)</b> [be x4; stop]            Robbery 14.1.04: <b>36% (4/11)</b> [be x4]            Robbery 22.1.04: <b>55% (6/11)</b> [be x5; stop]</p> <p>Cat 11.9.03: <b>82% (9/11)</b> [be x4; get x3; go; fall]            Cat 14.1.04: <b>45% (5/11)</b> [be x3; get x2]            Cat 5.2.04: <b>82% (9/11)</b> [be x4; get x3; try; fall]</p> <p>Dinner Party 3.7.03: <b>50% (9/18)</b>            [go x3; be x2; have; come; cook; shake]            Dinner Party 14.1.04: <b>22% (4/18)</b>            [say; come; be; put]            Dinner Party 4.2.04: <b>17% (3/18)</b> [come; set; be]            Dinner Party 29.4.04: <b>28% (5/18)</b>            [be x2; have; shake; come]</p>

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Category of result	Writing to Dictation task & details
Target main verb produced in different part of utterance	Robbery 14.1.04: <b>9% (1/11)</b> ['be']
Target main verbs → semantic substitutions (used correctly in utterance produced, unless indicated as an error)  Mean <b>11.1%</b> semantic substitutions per task, over 10 tasks (total 15)	Robbery 11.9.03: <b>27% (3/11)</b> [saying → 'speaking']; [think → 'believe']; [running → 'going'] Robbery 14.1.04: <b>18% (2/11)</b> [talking → 'say' <b>error</b> ]; [saying → 'call'] Robbery 22.1.04: <b>27% (3/11)</b> [talking → 'calls']; [running → 'going']; [saying → 'callede' <b>error</b> ]  Dinner Party 3.7.03: <b>11% (2/18)</b> [said → 'told' <b>error</b> ]; [put → 'dress'] Dinner Party 4.2.04: <b>11% (2/18)</b> [shake → 'clasp']; [sit → 'seat' <b>error</b> ] Dinner Party 29.4.04: <b>17% (3/18)</b> [said → 'ask']; [sit → 'are waiting']; [set → 'is serving' <b>error</b> ]
Target main verbs → phonological/orthographic substitutions	Cat 11.9.03: <b>9% (1/11)</b> [trying → ' <u>driving</u> ']
Target main verbs → MIXED semantic + phonological/orthographic errors	Dinner Party 3.7.03: <b>5.5% (1/18)</b> [set → 'playst'] Dinner Party 14.1.04: <b>11% (2/18)</b> [set → 'settle']; [shake → 'clip']
Syntactic category errors	Dinner Party 4.2.04: [N dinner → V 'dined']
Target main verbs → substitution errors of unknown type Mean <b>8.3%</b> substitution errors per task, over 10 tasks (total 13 errors). Of these, 62% (8/13) were 'go' substitutions, 23% (3/13) were 'be' substitutions, and 15% (2/13) were other V substitutions.	Robbery 11.9.03: <b>18% (2/11)</b> [is → 'had have']; [nicked → 'do']  Cat 14.1.04: <b>9% (1/11)</b> [trying → 'got'] <i>due to early activation of verb 'get'</i>  Dinner Party 14.1.04: <b>28% (5/18)</b> [go → 'were'] x4; [is → 'will'] Dinner Party 4.2.04: <b>17% (3/18)</b> [be → have]; [go → 'has']; [go → 'put'] Dinner Party 29.4.04: <b>11% (2/18)</b> [go → 'are dressing']; [go → 'are']
Target auxiliary verbs produced correctly  Mean <b>20%</b> Auxs correct per task over 10 tasks (total 8)	Robbery 11.9.03: <b>0% (0/2)</b> Robbery 22.1.04: <b>50% (1/2)</b> [be]  Cat 11.9.03: <b>60% (3/5)</b> [be x3] Cat 14.1.04: <b>40% (2/5)</b> [have; be]  Dinner Party 3.7.03: <b>0% (0/4)</b> Dinner Party 14.1.04: <b>0% (0/4)</b> Dinner Party 4.2.04: <b>0% (0/4)</b> Dinner Party 29.4.04: <b>50% (2/4)</b> [be x2]



## Results

Category of result	Writing to Dictation task & details
Target auxiliary verbs <b>OMITTED</b>  Mean <b>50%</b> Auxs omitted per task over 10 tasks (total 20).	Robbery 11.9.03: <b>50% (1/2)</b> [be]  Cat 11.9.03: <b>20% (1/5)</b> [have] Cat 14.1.04: <b>40% (2/5)</b> [have; be] Cat 5.2.04: <b>40% (2/5)</b> [have; be]  Dinner Party 3.7.03: <b>100% (4/4)</b> [would; like; be x2] Dinner Party 14.1.04: <b>100% (4/4)</b> [would; like; be x2] Dinner Party 4.2.04: <b>100% (4/4)</b> [would; like; be x2] Dinner Party 29.4.04: <b>50% (2/4)</b> [would; like]
Target auxiliary verbs produced in different part of utterance	Robbery 11.9.03: <b>50% (1/2)</b> [have]
Target auxiliary verbs → substitution errors Mean <b>6%</b> over 10 tasks.	Cat 11.9.03: <b>20% (1/5)</b> [have → be] Cat 5.2.04: <b>40% (2/5)</b> [have → be]; [be → have]

### 3.5 Phrasal substitutions in Writing to Dictation

There were a number of utterances produced by KB in the writing to dictation tasks that were best analysed as being a substitution of a whole phrase, rather than verbs alone. These appeared in eight out of ten of the writing to dictation tasks. Please see Box 1 below for a list of these phrasal substitutions.

Most of the phrases produced (61.5%, 8/13) preserved the same meaning as the target, e.g. *is having a snooze* → '*is sleeping*'; for the rest of the phrases, some were closer in meaning to the target than others. For instance, the substitution *and have a good time* → '*and drink the it*' was pragmatically related to the target, i.e. connected to the context depicted in the picture, while *have a good time* → '*laughed the food supper*' suggested the target meaning but did not express it clearly. Sometimes KB's produced phrase suggested that he was referring to the picture.

## Results

Given that the majority of these phrasal substitutions are semantically preserving the target utterance, it is reasonable to assume that KB used the lexical-semantic route in order to complete the task. They are evidence to suggest that the meaning of the target activated several ways of expressing that meaning.

Box 1: Phrasal substitutions produced by KB in Writing to Dictation tasks.

### Robbery:

Line 5 target: I **think** they've **nicked** something and they're **running** away.

KB 14.1.04: I **gotta** the two robbers **caught** up, I've the robber **caught** up.

KB 22.1.04: I'm their \_ robs \_\_\_ and they're **going** out.

### Cat:

Line 2 target: His father's **having** a snooze in the armchair.

KB 11.9.03: His father **is sleeping** on the chair.

KB 14.1.04: The father **is sleeping arise** in armchair.

KB 5.2.04: His father **is** little awake and the armchair.

### Dinner Party:

Line 2 target: He **said**: "**Would** you **like to come** for dinner?"

KB 14.1.04: He **have** to couple to \_\_\_\_\_.

KB 29.4.04: He **ask** a my the par dinner for.

### Dinner Party:

Line 6 target: They **go** to their bedroom and they **put** on their clothes.

KB 4.2.04: They **put** the bedroom and they've **dressed** \_\_\_\_\_ clothes.

KB 29.4.04: They **is are dressing** the bedroom and they **are dressing** clothes.

### Dinner Party:

Line 7 target: They **go** downstairs.

KB 14.1.04: They **y were** in hall. (*Motion/event left out, just the resulting state mentioned*)

KB 4.2.04: They **go out descend** the steps.

### Dinner Party:

Line 12 target: ...and **have** a good time.

KB 14.1.04: ...and **drink** the it.

KB 14.1.04: They **laughed** the food supper.

## 3.6 Other factors examined

The argument structure of verbs did not seem to make any difference to KB's correct or incorrect production of them: a comparison of verbs he produced correctly and those he omitted in writing to dictation tasks showed that for both groups the number of arguments the verbs took varied from one to three.

## Results

Furthermore, some of the same verbs (e.g. eat, go, cook) were produced correctly on some occasions but omitted on others.

Another factor considered was whether KB made more errors in longer and more complex sentences or not, i.e. whether his verb production was sensitive to processing complexity. For his written output, it was found that he produced very few syntactic structures that were more complex, e.g. [V NP PP] or similar, but nevertheless produced over 50% verbs correctly within this structure. In contrast, there were many examples in his written output of more simple syntactic structures, e.g. [V NP] or [V PP], but KB produced 55-80% of verbs incorrectly within these structures. Thus, from looking at written output only, it seemed that KB actually made more verb errors within simpler syntactic structures, but this comparison was skewed due to the very small numbers of more complex syntactic structures produced. Therefore the writing to dictation tasks mentioned in Section 3.4 (41 sentences of 4-8 words in length) were used to investigate processing complexity, as they comprised a more equal distribution of simpler versus more complex syntactic structures within the verb phrases. The results are shown in Table 5 below. Out of 25 simpler structures, KB produced 36% of verbs correctly, while in 12 more complex structures, he produced 33% of verbs correctly. These results indicate that there is no observable effect of processing complexity on KB's verb production.

Table 5: Percentage of correct and incorrect verb production within simpler and more complex syntactic structures.

	Simpler syntactic structures [V NP], [V PP] or [V AP]		More complex syntactic structures [V NP PP] or [V NP NP]	
Verbs CORRECT	<b>36%</b> (9/25)	Be, cook, write, read, eat, break, jump, win, draw.	<b>33%</b> (4/12)	Turn, meet, put, write.
Verbs INCORRECT	<b>64%</b> (16/25)	<u>Omitted:</u> be x4, fall, win, sit, lend, sleep, shout, see. <u>Substituted:</u> wash, eat, wait, catch, shoot.	<b>67%</b> (8/12)	<u>Omitted:</u> meet, give x2, put, take, buy, borrow. <u>Substituted:</u> meet.

#### **4. Discussion**

KB was found to produce main verbs accurately 96.5% of the time in his spoken descriptions while only 28.7% of the time in his written descriptions of the same picture or in the written version of the same task, indicating a modality-specific verb difficulty in writing. This verb difficulty was in the context of a more general difficulty with writing that resulted in shorter and less semantically and syntactically well formed utterances than in KB's spoken output. In addition, KB omitted nearly half (47%) of the required main verbs in written tasks, and nearly a third (31%) of the required auxiliary verbs, in striking contrast to no (main or auxiliary) verb omissions at all in spoken tasks. The lower percentage correct for verbs, coupled with the unique phenomenon of verb omissions in written output, provide strong evidence of a modality-specific verb deficit.

The semantic/conceptual theories outlined in the Introduction cannot explain these results, as outlined below. Instead, it is more plausible that KB has a verb-specific deficit at the level of orthographic lexical selection, "inviting the hypothesis that phonological and orthographic lexicons are organised by grammatical category" (Laiacona & Caramazza, 2004, p.106).

In contrast to verb omissions, which were specific to the written modality, verb substitution errors were made in both modalities in similar proportions, including a small amount of semantic, phonological/orthographic, and mixed substitution errors. This indicates that some processing difficulties may be common to both modalities. Although problems at the level of semantic selection can account for some of these modality-general errors, this alone cannot account for a modality-specific verb problem, as semantic substitutions occur across all syntactic categories (Bendre, 2004, see Section 2.2).

In writing to dictation, KB produced the target main verb correctly only 6.5% of the time. KB evidently found it more difficult to write a heard verb correctly than to write a self-generated verb correctly, which is consistent with previous findings

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that his ~~phoneme~~<sup>lexeme?</sup>-grapheme conversion route is damaged (Section 2.2 written output). Nevertheless, many of his substitutions preserved much of the meaning of the target utterances. Out of the morphological and semantic substitutions KB produced in writing to dictation, most (63% and 67% respectively) were appropriate to the context, despite not matching the dictation target. This data indicates that when KB makes substitutions, the likelihood of his producing something that is semantically appropriate is very high. These *appropriately used* verb substitutions were produced 14.6% of the time (approximately equally made up of semantic and morphological substitutions), which if added to the 6.5% he produced matching the target gives 21.1% as the proportion of verbs *used* appropriately in writing to dictation. This is more comparable to KB's performance in self-generated written descriptions, above (28.7%).

In writing to dictation, 11.1% of target main verbs were produced as semantic substitutions. In addition, KB produced semantically related phrasal substitutions in eight out of ten (80%) of the writing to dictation tasks. It is reasonable to assume that KB was using the lexical-semantic route, and that the meaning of the target activated several ways of expressing that meaning.

### 4.1 Implications

Bird, Howard & Franklin (2000) propose a semantic/conceptual explanation for impairments in verb processing by arguing that the apparent verb deficit is in fact due to the lower imageability of verbs, as compared to concrete nouns. This theory predicts that verb/noun dissociations are eliminated when verbs and nouns are matched for imageability. This is true for KB's performance on An Object and Action Naming Battery (Druks & Masterson, 2000), where he scored identically for single naming of objects and actions, and these had been matched for imageability and frequency (see Section 2.2). However, Bird et al's theory also predicts that the pattern of difficulty (e.g. similar error types and similar percentages of correct verbs) would be common to spoken and written output as well as comprehension, since an imageability problem would affect the semantic

## *Discussion*

system. Neither of these predictions are true of KB's performance: he has a modality-specific verb output deficit, and his performance in written output is inferior to both his spoken output and his comprehension. Therefore, a semantic/conceptual explanation of verb impairment cannot account for KB's modality-specific verb impairment.

Turning to syntactic theories of syntactic category-specific deficits, a general syntactic deficit would predict that sentence production is impaired in addition to a problem retrieving verbs. Evidence against a more general syntactic deficit (i.e. a sentence processing problem) is that KB's retrieval of verbs was not influenced by the complexity of the target utterances; Berndt et al (1997) have reported similar findings. KB produced sentences that were often syntactically and semantically well structured even when a verb had been omitted, such as "Four couple in the dinner room", where the verb 'go' has been omitted, but the noun arguments and other structures are present. Even though his written utterances were shorter and less well formed than those in spoken output, they were still good relative to his verb difficulty in writing. There is anecdotal evidence from KB's clinical file that being given a verb cue does not improve his sentence structure, which is usually already correct. This is not what would be expected if sentence structure depended on verb retrieval. Some researchers have argued that access to the semantics (Garrett, 1988; Levelt, 1989) and also phonology (Marshall, Pring, & Chiat, 1998) of verbs enable sentence production, and so it could be argued that KB's fairly intact access to both the semantics and phonology of verbs enables his relatively good sentence production in writing.

Another syntactic theory is the lexical hypothesis, which posits that grammatical category information relating to nouns and verbs may be stored in different cortical areas, which can be damaged selectively by a stroke (Miceli et al, 1984, 1988; Caramazza & Hillis, 1991; Hillis & Caramazza, 1995). This explanation does not depend on an association with global syntactic difficulties. It is clear that KB does not have a verb deficit across modalities, ruling out a difficulty for verbs in a modality-independent lexical component. Hillis & Caramazza (1991)

## *Discussion*

conclude from their study that “we should give serious consideration to the possibility that grammatical category information is represented separately and redundantly in each modality-specific lexical system”, which would account for KB’s difficulty as damage to the verb-specific domain of his orthographic output lexicon.

Following on from this consideration, Caramazza (1997) proposed the Independent Networks (IN) hypothesis as an alternative to the lemma-based theories of Levelt, Roelofs and Meyer (1999). The IN model postulates that grammatical information is accessible directly at the level of modality-specific output lexicons (see Figure 1, Section 1.3) Within this model, KB’s modality-specific deficit for verb production in writing would be explained by selective damage to the verb domain of the orthographic output lexicon and its associated syntactic network.

A different possibility to account for KB’s modality-specific verb deficit would be that the processing route/pathway from semantics to orthography *specific to verbs* is impaired, while the processing route from semantics to phonology is mostly intact. A similar suggestion has been discussed by Rapp and Caramazza (1998).

Evidence for the grammatical cause of noun/verb dissociations is provided by Shapiro et al (2000). They showed that difficulty in producing words of one grammatical category is associated with difficulty in producing morphology for that grammatical category. The present study shows that KB has difficulty producing verbs in writing, and Kidger (2005) shows that KB’s difficulty with morphology is more pronounced in the production of verbs than nouns, particularly in writing to dictation and written output. Therefore, it seems likely that a grammatical explanation is key to KB’s verb difficulty.

For this patient, therefore, a form-related explanation of the type that Caramazza and colleagues have developed seems to be appropriate. However, some

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additional assumptions would be necessary in order to account for some of the other patterns in KB's data, such as substitutions that imply a summation of information from different levels of processing.

### **4.2 Other patterns**

As raised in Sections 3.2 and 3.4, some of KB's substitution errors in writing and writing to dictation indicate the possibility of a *summation* of semantic and phonological/orthographic information in selecting a candidate verb to be produced, e.g. *tripped over* → '*toppled*', *set* → '*playst*', *set* → '*settle*', *shake* → '*clip*'. This summation possibility was proposed by Hillis and Caramazza (1991) to account for some patients' ability to read poorly understood irregular words, but it could also account for the summation of semantic information with phonological and/or orthographic information in activating lexical items for writing (see also Alario et al., 2003)

KB also makes substitution errors in writing and writing to dictation for which there is little or no semantic similarity to the target verb, but where there is considerable *phonological* similarity to the target, as detailed in Sections 3.2 and 3.4: *rest* → '*left*', *trying* → '*driving*'. These errors suggest that phonological rather than orthographic information was primarily responsible for their selection and production. This is possible evidence for: either (a) a direct pathway between phonological and orthographic lexicons; or (b) that the two are not totally independent; or (c) that there is "cross-talk" between the two lexicons (e.g. Bub, Cancelliere, & Kertesz, 1985; Coslett, 1991; Funnell, 1983; Sartori, Masterson, & Job, 1987; cited by Alario et al., 2003). Considering these possibilities in the light of KB's profile, option (b) seems unlikely, as it would not be able to account for the general modality-specific effect of shorter and less semantically and syntactically well formed utterances in writing, which suggests that the two lexicons are independent. Option (a), a direct pathway between the phonological and orthographic lexicons seems to imply that a direct conversion from phonological lexemes to orthographic lexemes, and the reverse, would be



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possible. This does not seem plausible in KB's case, considering the disparity between his spoken and written output. The remaining option, (c), that there is "cross-talk" between the two lexicons, is assumed to involve less 'direct' pathways than in option (a) but nevertheless to allow some flow of information between the two lexicons. This seems to be the most plausible claim, as it would account for the low frequency of these error types in KB's written output.

In the data analysed for this study, KB made some (18) spelling errors on nouns, and the spellings used on different occasions varied, e.g. 'newsagent' was written as NEWAJENT and NEWSAJENT in written output, and as NEWSGAIN, NEWAJENT and NEWSAJENT in writing to dictation. This shows that there was either incomplete information about the spelling of 'newsagent' available to KB, or that there were problems in assembling the appropriate graphemes for motor execution. Despite KB's problems with verbs, he only made 3 or 4 spelling errors on the verbs he produced in this data set. It is very unlikely that a later level of processing, such as the graphemic buffer, would be category specific. If it was, the verb spellings would be affected, but this is not the case. Indeed, there are very few verb misspellings in KB's written output, whereas misspelled nouns are more common. Therefore, even though he may have some graphemic output problems, these cannot explain the verb specificity. These results are more consistent with the possibility of incomplete orthographic representations for some words, nouns especially, in the orthographic output lexicon. Given that most of KB's written output is spelt correctly, this seems to be a minor problem; nevertheless, it may interact with difficulties at other levels of processing.

KB showed a difficulty producing main verb 'be' in writing: in written tasks, 27% of main verb omissions were of main verb 'be', and in writing to dictation tasks, omissions of main verb 'be' accounted for 51% of all main verb omissions. This difficulty is thought to be related to KB's previously documented difficulty with function words, in that main verb 'be' has many of the syntactic and phonological properties of function words (see Black & Chiat, 2003).

### **4.3 Concluding remarks**

This is another case study that argues against purely semantic explanations of noun/verb dissociations, as the data clearly show modality specificity. But, with the available data, and without further experimental investigation, it is not possible to go beyond Caramazza and colleagues' suggestion that there are either separate processing routes from semantics to forms for nouns and verbs, or separate domains within each output lexicon for each grammatical class.

An unfortunate limitation of this study was the inability to conduct further testing with KB. This was obviously a drawback, however, the existing data available made up for it. Different types of identical tasks (e.g. more procedural tasks, or telling a story from memory in both modalities) would have added weight to the data analysed here, but clearly, only existing data could be used.

Although it will not be possible to do further assessment with KB himself due to his second stroke (which has changed his psycholinguistic profile), ideally it would be desirable to follow up some of the issues raised by this case study, for instance, how imageability effects can be resolved within a modality-specific verb deficit. This would be worth following up systematically with a similar patient.

In going from semantics to phonology, KB's problems are not that great: he always has access to *something*. In writing, however, very often he doesn't have access to the form at all. A theory is needed that explains why nearly half of KB's responses in writing are not even contacting a form, while this doesn't happen in speaking.

Caramazza and other researchers have given patients with modality-specific verb problems noun/verb homonyms, in order to test what happens when phonological and orthographic forms are identical, while syntactic categories differ. Following on from this, it would be even better to distinguish *semantic* differences between noun/verb homonyms, so that there is both a semantic and

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syntactic difference between the noun and the verb. E.g. 'paint' and 'iron' the nouns express objects ('the paint' or 'the iron'), whereas their verb counterparts ('to paint' and 'to iron') express actions. These types of noun/verb homonyms could be contrasted with those where both the noun and the verb express events, e.g. sleep ('a sleep' vs. 'to sleep') and walk ('the walk' vs. 'to walk'). If there were semantic effects in writing, you would expect the first pair type to be treated differently, so that a patient such as KB would have more problem with 'iron' and 'paint' the verbs than 'iron' and 'paint' the nouns. For the second pair type you would expect performance to be more equal as both the noun and the verb are semantically the same, i.e. the syntactic category difference should disappear. If syntax were at the root of the problem, the semantic differences between these two types of homonym pairs would not have an effect: performance would be similar for both.

KB's profile will add to the literature on modality-specific grammatical category problems, which should assist in future theories on language processing and future intervention for acquired language difficulties.

Word count: 9,998.

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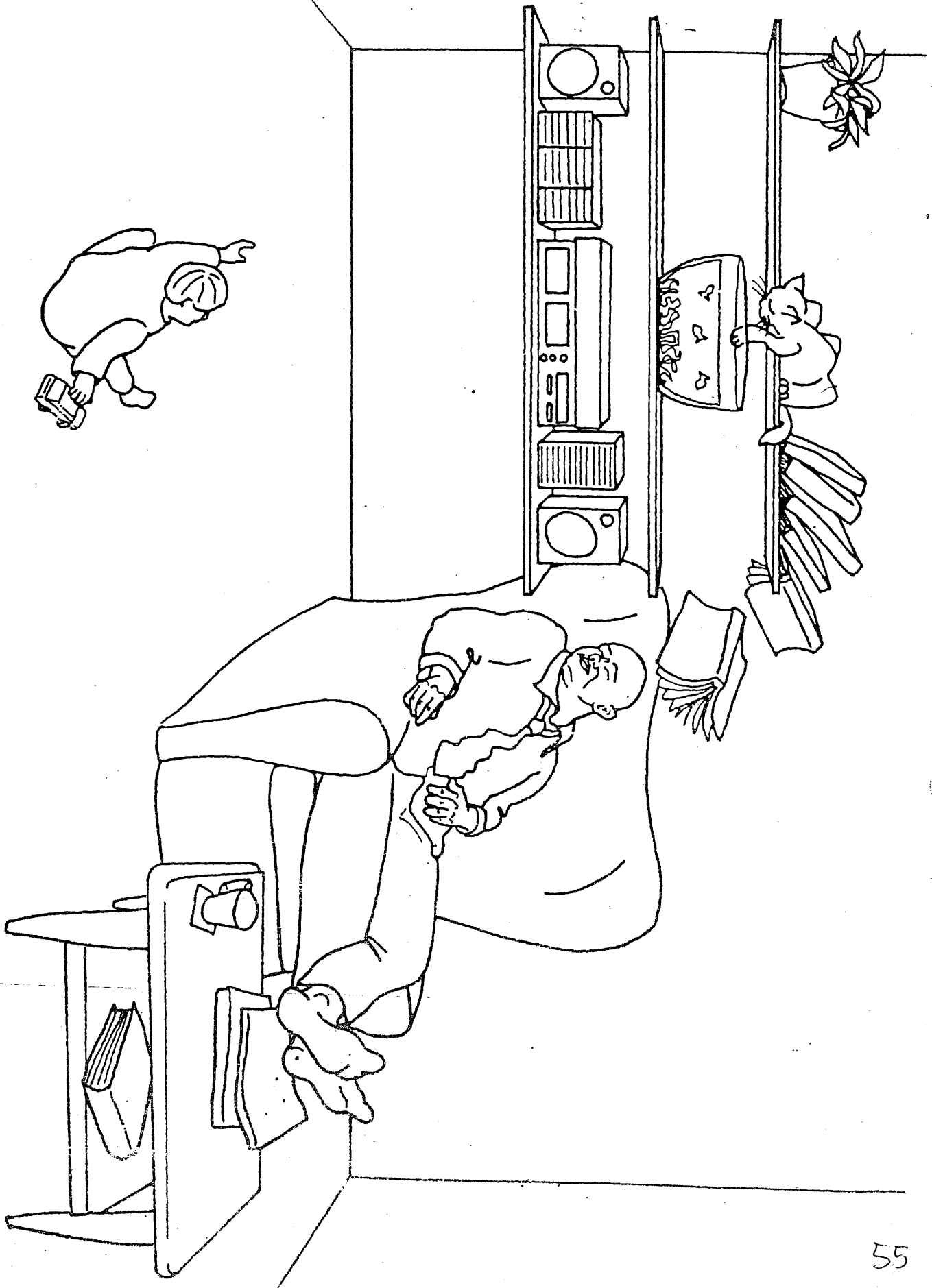
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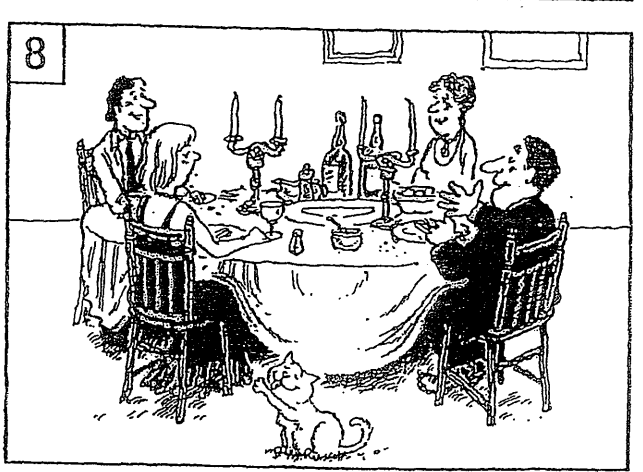
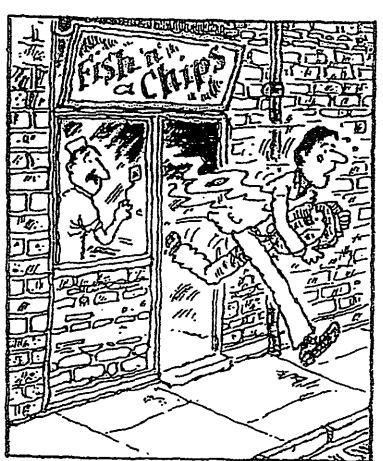
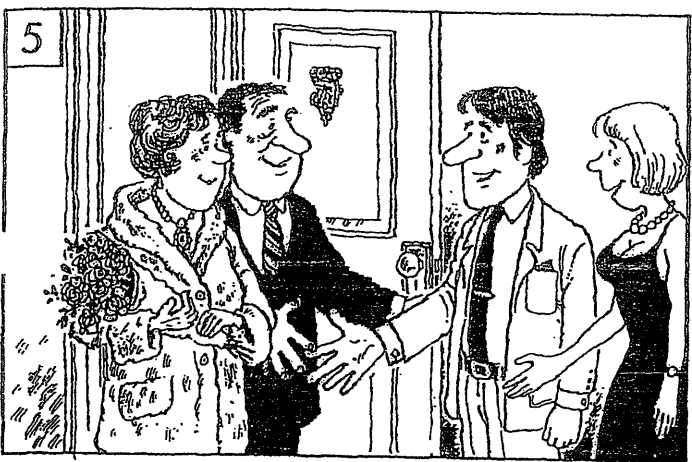
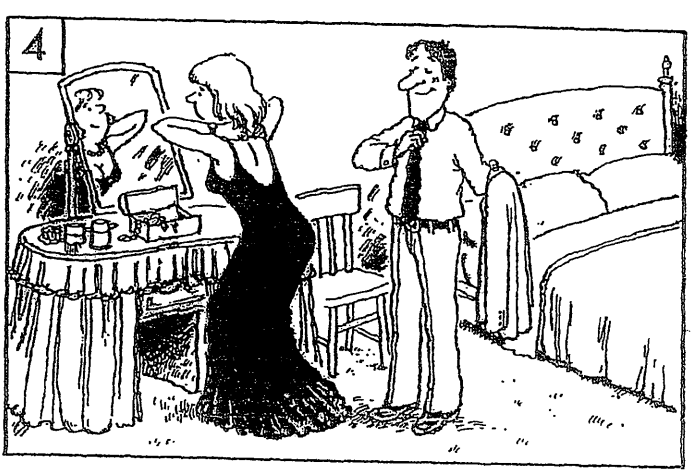
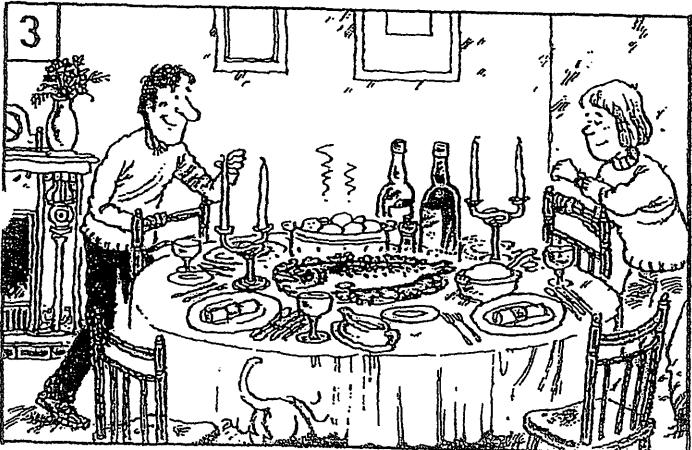
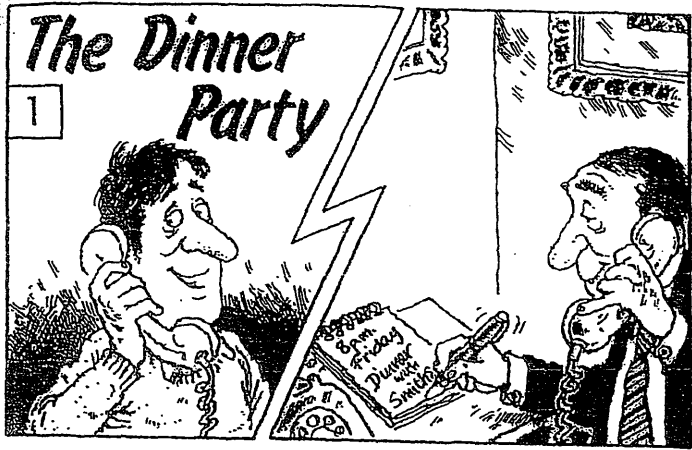


POST OFFICE

SHOE REPAIR

NEW





## Appendix 2

### Spoken output of 'The Cat' picture 1.7.03

1. Well **we're** in a ina umm... um... um... a sitting room //
2. and **there's** a... baby in in the floor //
3. *and and **she's** /b/ on a small child anyway // [on=only]*
4. and **she's got** um..... **She's got** a a a a... little toy car beside him. //
5. Beside him **there's there's** a man **that's** probably his father **having** a snooze in an armchair //
6. and **he's got** his feet *um his feet [omitted: 'on the table']*umm... umm and his feet **haven't got** any shoes on. //
7. *Um um um um* and some... *um... paper some some on the his on on the um um on the his little chair sorry the table//*
8. and on the table **there's** also *um ah ah* a mug
9. and *or the um the ah* then *there I'm sure* **there's** a book on there //
10. and then on the side **there's** a *um* tape recorder *no not a tape recorder a..... a thing oh sorry um (therapist prompts 'hi-fi' and KB repeats 'hi-fi') //*
11. and above that **there's** a bowl of *um..... (therapist prompts 'gold-fish' and KB repeats 'golden fish') //*
12. and above that **there's** a *a um* cat **who's trying** *um to um* **she's trying to get to get** *one of the one of them. //*
13. **She's trying to get** them but **hasn't succeeded.** //
14. And above /ð/ the side **there's** some books that **are falling** down on the man's face //
15. and um **I don't think there's** anything else.

### Written output of 'The Cat' picture 3.7.03

1. ~~A livn~~ The living room.
2. The a cat ~~up~~ on the shelf, his he **catch up got** a the goldfish on bowl on a ~~t~~ shelf another, ~~music~~ music ~~th~~ radiophonic.
3. The sleepy man in a ~~armear~~ chair.
4. His feet **left** on a table.
5. The a cup on the table.
6. On the floor the young child **play** a car.

**Spoken output of 'The Cat' 7.1.04**

1. Well **it's** a living room //
2. and there **are** three shelves on the wall //
3. and on the top shelf there's a cat and some books // and a um a um um a /f/ plant //
4. and the cat **is trying to get** a um **to get** the /f/ fishes // in the *in the* next shelf as some yeah as some a goldfish //
5. and she **couldn't succeed** //
6. but the books beside her **are falling** down on a man **who's** in a /s/ /s/ sitting room in an armchair //
7. and **he's** sort of asleep //
8. and um his ah feet **are resting** on a table cloth *ah on a um on a um..... on a um* tray on a table //
9. and **there's** also a cup there //
10. and *um* the table cloth the there **has** another shelf below that //
11. because of course **there's** another book there //
12. and *um* in the third shelf on the wall **there are** speakers // *and all these various things you've got that // loudspeakers and all the rest of it //*
13. and in the *in the* floor **there's** a terribly small baby //
14. and **he's got** his little /k/ *um* car //
15. *and I don't think there's anything else to say.*

**2. d) Written output of 'The Cat' 8.1.04**

1. A living room.
2. The three shelves on the wall.
3. Top ~~the~~ the shelf, a cat **put** a ~~goldfish~~ goldfish the middle shelf.
4. The books on the top shelf **fall** on a man, **sleep** on armchair.
5. His feet on a table.
6. The a cup, a book on shelf on the table.
7. The a little boy on the floor, his a toy motor clars.
8. The lower shelt +, music -

Appendix 2

**DICTIONARY TARGET for 'The Cat' (based on KB's spoken output and used for every writing to dictation task for 'The Cat'):**

1. There's a baby on the floor and he's got a little toy car beside him.
2. His father's having a snooze in the armchair.
3. He's got his feet on the table.
4. On the table there's a mug and some books.
5. Beside him there's a tape recorder and some goldfish.
6. The cat's trying to get one of them.
7. There are some books that are going to fall on the man's head.

**11 Vs total in above target:**

be x4 (is, is, is, are)  
get x3 (got, got, to get)  
have x1 (having)  
try x1 (trying)  
go x1 (going)  
fall x1 (to fall)

**5 Aux.s total in above target:**

have x2 (has, has)  
be x3 (is, is, are)

Appendix 2

Writing to dictation 'The Cat' 11.9.03 INPUT-OUTPUT

Target (numbered) with KB's output written under each one, and main analysis under KB's output:

1. There's a baby on the floor and he's got a little toy car beside him.  
KB: A child on the carpet/floor. ~~There~~ the he **is** a small car ~~is~~ ~~behind~~ ~~the~~.  
OMISSIONS of target main Vs 'is' & 'got'; Aux error (has→ 'is')
2. His father's having a snooze in the armchair.  
KB: His father **is** (*undecipherable crossed out word*) **sleeping** on the chair.  
Phrasal substitution preserving meaning.
3. He's got his feet on the table.  
KB: His feet on the table.  
OMISSIONS of target Aux & main V: 'has got'
4. On the table there's a mug and some books.  
KB: The on table a cup jug, ~~th~~ a books.  
OMISSION of target V 'is' or suitable other V.
5. Beside him there's a tape recorder and some goldfish.  
KB: His a \_\_\_ a goldfisks.  
OMISSION of target V 'is' or suitable other V.
6. The cat's trying to get one of them.  
KB: The cat **is** ~~caught~~ driving (*KB underlined this word*) a goldfisks.  
Aux 'is' (correct); V 'driving' assumed to be error of form: trying→ 'driving'  
N.B. the fact that he underlined it may signal his awareness of the error.  
OMISSION of target V 'to get'
7. There are some books that are going to fall on the man's head.  
KB: The ~~three~~ – books **are** \_\_\_ only the man's forehead.  
Aux 'are' (correct); OMISSIONS of target Vs 'are', 'going' & 'to fall'

**Writing to dictation 'The Cat' 14.1.04 INPUT-OUTPUT**

Target (numbered) with KB's output written under each one:

1. There's a baby on the floor and he's got a little toy car beside him.  
KB: A little boy on the floor and boy on # a little toy motorcar beside him.  
OMISSIONS of main Vs 'is' & 'got' & Aux 'has'

2. His father's having a snooze in the armchair.  
KB: The father is (KB added 'is' as an insert) sleeping arise in armchair.  
Phrasal substitution [is having a snooze → 'is sleeping'].

3. He's got his feet on the table.  
KB: He's the his feet upon the table.  
OMISSION of main V 'got'

4. On the table there's a mug and some books.  
KB: As on table, a jat (*jar? Unclear handwriting*) and the books.  
OMISSION of main V 'is'

5. Beside him there's a tape recorder and some goldfish.  
KB: He on his as (*as? But not written like usual 's'*) soon a loudspeak and goldfishes.  
OMISSION of main V 'is'

6. The cat's trying to get one of them.  
KB: The cat is got her got they their.

7. There are some books that are going to fall on the man's head.  
KB: An you e \_\_\_ books, they go uset (*user?*) the father's head.  
OMISSIONS of main Vs 'are' & 'to fall' & Aux 'are'

**Writing to dictation (without picture) for 'The Cat'**

**5.2.04**

Target (numbered) with KB's output written under each one:

1. There's a baby on the floor and he's got a little toy car beside him.

KB: A baby on the floor (*single letter crossed out*) and he's a small very car a he've his.

OMISSIONS of main Vs 'is' & 'got'

2. His father's having a snooze in the armchair.

KB: His father is little awake and the armchair.

Phrasal substitution: [is having a snooze → 'is little awake'].

3. He's got his feet on the table.

KB: His t feet across the table.

OMISSIONS of Aux 'has' & main V 'got'

4. On the table there's a mug and some books.

KB: The \_\_\_ feet a \_\_\_ job (*jar? The 'b' of 'job' also looks like it has the letter 'r' on top of it*) and books.

OMISSION of main V 'is'

5. Beside him there's a tape recorder and some goldfish.

KB: A \_\_\_ his and a tape report and small goldfish.

OMISSION of main V 'is'.

6. The cat's trying to get one of them.

KB: The cat've \_\_\_ the goldfish.

OMISSIONS of main Vs 'trying' & 'to get', & Aux error *is* → 've.

7. There are some books that are going to fall on the man's head.

KB: The \_\_\_ books go along with him a forehead.

OMISSIONS of main Vs 'are' & 'to fall'



Appendix 2

**Spoken output of 'The Robbery' picture      1.7.03      OUTPUT**

1. It's a street and there **are** three shops *um* in the background.
2. One **is** a post office and *there* there's a shoemaker and this **is** a newsagents (*pointing*).
3. And then on top of that there's a man at the *um* post office and *he's* **saying** he's **chatting** to two robbers.
4. And there's a woman who's *ah* very old *I think*.
5. There's a bus there and she's **got** a stick and she **doesn't do** anything
6. and then there **are** two guys who **are** also **saying** 'stop that' to the two robbers
7. and the two robbers **look** as if they **are** same age as those boys
8. *and the* and one **has** a spanner and **is wearing** a *um* hat of some sort of description and something in his eyes.
9. *I think um* one **doesn't know** that he's **got** glasses on.
10. The other one **has** a cap on and *um* something on his eyes so you **can't see** him
11. and they've **got** a basket here *I think* which they've **done** various things (*assumed to be a typo for 'things'*) with it
12. so they've **nicked** something and they're **running** away
13. *and that's all I think.*

**Written output of 'The Robbery'      3.7.03      OUTPUT**

1. The street in the ~~te~~w town.
2. These three shop, P.O., the shoe repair, and Newajent.
3. The shopman **called** two ~~b pu~~ bulgar,
4. the old woman beside bus stop.
5. The two young men, and two bulgar, their costumes, (*unreadable 2 letters crossed out*) and bags prizes, glasses ~~spanne~~ spanners.

**Spoken output 'The Robbery' 7.1.04 (post VRS therapy) OUTPUT**

1. Well it's a high street
2. and there's a post office
3. and *bi f* and */af/* the post office there's a shop **selling doing** shoes...  
and... a... newsagent there
4. and there there's a man a **streaming** a at the post office
5. *I think she's* he's the manageress because some robbers two robbers *ah*  
**have ah ah been** there *ah* and *I think they they they've got* some some  
money from him *I suppose*
6. and then beside him *there's a man* there's a woman at the bus stop
7. *um* she's **got** a stick and she's quite old and she's **got** a *um* a bag and  
she's **waiting** for the bus
8. and it's *it's umm a /f/ /f/ /f/ sixty /s/ /s/ thirty no twenty... (laughs)... fifty*  
*/wa/ bus*
9. *well I think it's the bus*
10. *I'm not sure*
11. *um ah* then *um ah beside* beside *the manageress* the manager of the post  
office there **are** two boys and they're **staying**, (*either typo for 'saying' or*  
**phonological error in pronunciation of 'saying'?**) "there **are** the robbers  
there"
12. there **are** two robbers beside them
13. and the two robbers **have um have um put** on a disguise
14. *not very good*
15. they've both **got** a *um a um a um* a beret
16. or a not a beret but a but a hat of some sort like that
17. one of them **has** glasses
18. and he **has** a span
19. and he's **got** a bag in the other hand which presumably **has** lots of money
20. and the other man **has um ah um** a handkerchief *or whatever you call*  
*that on um* his face and he's **got** a bag on the other side
21. and they're **running** away
22. *and I can't think of anything else to say.*

**Written output 'The Robbery' 8.1.04 (post VRS therapy) OUTPUT**

1. A high street.
2. Three shops accross the street, a post office, shoe repair shop, a n  
newsagent.
3. The manager of the post office **called** two ~~three~~ thieves middle of the  
street, ~~tw~~ the **running**.
4. The thieves, their caps, his the spanner.
5. The bag, the others for bag, whole money.
6. The other two men **called**.
7. A old woman **stop** ~~step~~ bus.

**Writing to dictation, 'The Robbery' 11.9.03 INPUT-OUTPUT**

Target (numbered) with KB's output written under each one:

1. There's a street with three shops.

KB: The street ~~b~~ **had have** three shops. (had & have written above as thought of later)

2. One **is** a post office and there's a shoe shop and a newsagents.

KB: ~~On s~~ A one a postal shop, one shopping, ~~on~~ a newsgain.

3. There's a man **talking** to two robbers.

KB: A man **talking** two bulger

4. There **are** two guys **saying** 'stop that!' to the robbers.

KB: and two ~~yong~~ ~~younger~~ man ~~ta~~ **speaking** \_\_\_\_, quiet two trickser.

5. I **think** they've **nicked** something and they're **running** away.

KB: "I **believe**", a they **do** enough, they've (*could be 'they're' but judging his handwriting seems more like 'they've'*) ~~m~~ if **going** back.

**Writing to dictation 'The Robbery' 14.1.04 (post VRS thpy) OUTPUT**

Target (numbered) with KB's output written under each one:

1. There's a street with three shops.

KB: The street ~~are~~ **is** three shops.

2. One **is** a post office and there's a shoe shop and a newsagents.

KB: A *the* a post office and a either side, a shoe shop and a newagent.

3. There's a man **talking** to two robbers.

KB: The outside man **say** a couple thieves.

4. There **are** two guys **saying** 'stop that!' to the robbers.

KB: The double guys **call** you're **said** the two thieves. **COME BACK TO**

5. I **think** they've **nicked** something and they're **running** away.

KB: I **gotta** the two robbers **caught** up, I've the robber **caught** up.

Appendix 2

Writing to dictation      'The Robbery' 22.1.04 (without picture)  
OUTPUT

Target (numbered) with KB's output written under each one:

1. There's a street with three shops.

KB: The street in three shops.

2. One is a post office and there's a shoe shop and a newsagents.

KB: A post office\_\_ and the a ðe ð shoe repair a newsagent. **Say it's OK**

3. There's a man **talking** to two robbers.

KB: A ðe young man **calls** † a young thieves.

4. There **are** two guys **saying** 'stop that!' to the robbers.

KB: A new men **calleds** the † robbery \_\_ and the thieves.

5. I **think** they've **nicked** something and they're **running** away.

KB: I'm their \_ robs \_\_ and they're **going** out.

**WRITTEN PIC DESCRIPT DINNER PARTY      27.2.03      OUTPUT**

1. The man **is telephoning** and another man when invitation of dinner.
2. The woman and her husband **are cooking** the dinner.
3. The man and his wife **keep** the table. **OMISSION of V (probable V 'set')**
4. The woman and her husband in bedroom **is dress**.
5. The two **OMISSION of V and most of sentence!**
6. The women and two man                      food. **OMISSION of V (probably 'eat'/'are eating')**
7. The women **is**
8. The man **is**                      fish & chips **OMISSION of main V (e.g. 'buying', 'getting')**
9. The men and two women **is** thankily

**SPOKEN OUTPUT DINNER PARTY                      13.3.03      OUTPUT**

1. The husband **is um phoning** a friend, a, a, um, the um, guest **saying would** (*omission of pronoun 'he'*) **like to come** to dinner.
2. The husband, then, and his wife **are** in the kitchen and **he's washing** the dishes and she **is cooking**
3. then the husband and the wife **go** into the dining room where **they're setting** the table for the dinner,
4. and **they've got** bottles of wine and um um (*traces /k/*)... candles, **they've got candles**
5. then they **go** to their bedroom where they **are** um **putting** on their clothes, nice clothes and **she's got** a nice dress, um
6. and then they **go** out, downstairs and into the *err* front door where the guests **have just arrives** and they **shake** hands,
7. then they all **go** to *the kitchen the*, the, dining room *um* where there **are** bottles of wine and candles and um ... napkins, but **there's** no food there!
8. And suddenly they **realise there's** no food there,
9. the, the hus... wife **is** very embarrassed,
10. but the husband **goes** outside and **goes** to the *err* fish and chip shop and he **buys** lots of things there
11. and then they **sit, sitting** down in the dining room **having** a good time with their chips and thingies.

**SPOKEN OUTPUT DINNER PARTY      07.01.04      OUTPUT**  
**(Post VRS Therapy)**

1. The husband **is phoning** some *ah* people *for* **to invite** them for dinner. //
2. *um and the* and you **can see** the other man *ah um ah* **saying** "yes Friday **would be** lovely" //
3. *Din ah* dinner at Smith's at 8 o'clock. //
4. So then on Friday with the *m m* the wife and the husband *is are or are are* in the kitchen //
5. *Ah* **she's doing** various things on the stove //

## Appendix 2

6. *um* and *he* **he's washing** up *um* //
7. *ah um* and you **can see** on the breakfast table **there's** a huge fish //
8. the next thing **is** *is they're* **they're** in the drawing dining room and **they've got** this lovely table there with .....*s*..... *um ....um mm....candles* and lots of *w... wine* and so forth //
9. and the fish *which has been* which *they* **they've done** **is** there *in* in the middle //
10. and it **looks** absolutely lovely //
11. then they **go** up to their *um their... um.. um.. ah..* bedroom and **put** on new clothes //
12. *um* he **put** on a suit and a tie // *and and a tie*
13. *I don't like ties very much* //
14. and **she's got** a lovely dress // *um* a dress which **is** on to the floor // *um you know a big one // a um an evening um um what ah an yeah evening dress yes //*
15. *um* and **she's looking** at herself in the mirror and he **looks** lovely as well //
16. and then the guests **arrive** just one another couple //
17. and they **go** in /*k/ /k/* *go in* the hall //
18. and **they're looking** absolutely lovely //
19. then they all **go** to the *hall drawing r the* dining room //
20. and the *a* fish **has disappeared** //
21. terrible terrible terrible //
22. and *the um* **they're thinking** "God **what's happened?** *What's happened?"* //
23. and *um* the man **goes** *and goes* to the fish and chip shop //
24. and they **have** a lovely time *by* after all with the *with* fish and chips *um on* a which they **got** from the shop //
25. and you **know** *who* what **happened** of course the cat **has licked** the fish //
26. and **he's having** a very good time like that //
27. and **they're having** lots of wine etc etc //
28. *and that's it.*

**WRITTEN OUTPUT DINNER PARTY 08.01.04 OUTPUT**  
**(Post VRS Therapy)**

1. Mr Smith
2. A husband **telephone**.
3. He **talks** a husband **eat had** dinner 8pm Friday.
4. Friday, the couple with kitchen.
5. She **cook** in stove.
6. He **is washing** the plates.
7. The fish on the table.
8. The couple in the dinner.
9. The fish on the table, on two wine **to** bottles.
10. Four candles.
11. Two on the **to** bedroom, **eat dressing** – wife long dress.
12. Husband **to dress\*** suit. **NB cd be 'husband wears a dress suit' therefore cd be omission of V 'wear'.**
13. The couples **call**.
14. Four couple in the dinner room.
15. A fish **dissappeared**.
16. Husband **go** fish and chips.
17. Their on the dinne.
18. A cat **eat** only the fish.

**Dictation Target for 'The Dinner Party' (based on KB's output):**

1. The husband **phones** a friend.
2. He **said**: "Would you **like to come** for dinner?"
3. The husband and wife **are** in the kitchen.
4. He's **washing** the dishes and she's **cooking**.
5. Then they **go** into the dining room where they **set** the table for dinner.
6. They **go** to their bedroom and they **put** on their clothes.
7. They **go** downstairs.
8. They **shake** hands with the guests.
9. Then they all **go** into the dining room.
10. But there's no food!
11. The husband **goes** to the fish and chip shop.
12. Then they **sit** down in the dining room, **eat** the fish and chips and **have** a good time.

**DINNER PARTY DICTATION 03.07.03 INPUT-OUTPUT**

Target (numbered) with KB's output written under each one:

1. The husband **phones** a friend.  
KB: The man **telophoned** towards another man.

## Appendix 2

2. He **said**: “**Would you like to come** for dinner?”

KB: ~~W~~ He **told** his then old dinner.

3. The husband and wife **are** in the kitchen.

KB: The man and woman in the kitchen.

4. He's **washing** the dishes and she's **cooking**.

KB: The man **washes** a dishes; the woman \_\_\_\_\_ meal.

5. Then they **go** into the dining room where they **set** the table for dinner.

KB: A The w. in the dinner room. In they **playst** the dinner room.

6. They **go** to their bedroom and they **put** on their clothes.

KB: They **went** the either bedroom. They † **dress** the clothes.

7. They **go** downstairs.

KB: On they couple on the \_\_\_\_\_

8. They **shake** hands with the guests.

KB: Handup ~~the~~ a couple.

9. Then they all **go** into the dining room.

KB: ~~The~~ The couple a in the dinner room.

10. But there's no food!

KB: \_\_\_\_\_ A The food.

11. The husband **goes** to the fish and chip shop.

KB: The husband **goes** a fish & chips.

12. Then they **sit** down in the dining room, **eat** the fish and chips and **have** a good time.

KB: The any **sits** in the dinner room. They **eat** the fish & chips & and comfortable ~~d~~ **sits**.

### WRITING TO DICTATION DINNER PARTY 14.01.04

Target (numbered) with KB's output written under each one:

1. The husband **phones** a friend.

KB: A husband **telephoned** of couple.

2. He **said**: “**Would you like to come** for dinner?”

KB: He **have** to couple to \_\_\_\_\_.

3. The husband and wife **are** in the kitchen.

KB: He and wife in the kitchen.



## Appendix 2

4. He's **washing** the dishes and she's **cooking**.

KB: He **washes** the plates and she **cook**.

5. Then they **go** in the dining room where they **set** the table for dinner.

KB: ~~the~~ They **were** the ~~dan~~ \_\_\_ and they **settle** the table the.

6. They **go** to their bedroom and they **put** on their clothes.

KB: They **were** a bedroom and they \_\_\_\_\_ their dresses.

7. They **go** downstairs.

KB: They **were** in hall.

8. They **shake** hands with the guests.

KB: They **clip**, their .

9. Then they all **go** into the dining room

KB. They simple **were** in the room.

10. But there's no food!

KB: The **will** I food.

11. The husband **goes** to the fish and chip shop.

KB: The husband **go** the fish n clips shop.

12. Then they **sit** down in the dining room, **eat** the fish and chips and **have** a good time.

KB: Then the **sit** in the d. room. They **eat** the fish & chips and **drink** the it.

### DICTATION DINNER PARTY 04.02.04 OUTPUT

Target (numbered) with KB's output written under each one:

1. The husband **phones** a friend.

KB. A husband **telephoned** a friend.

2. He **said**: "Would you like to come for dinner?"

KB. He **says** to a my small my dinner.

3. The husband and wife **are** in the kitchen.

KB. The husband and wife **have** the kitchen.

4. He's **washing** the dishes and she's **cooking**.

KB. He **washes** the plate (things), ~~h~~ and a wife **cooking**.

5. Then they **go** into the dining room where they **set** the table for dinner.

*Appendix 2*

KB. The they **has** in the dining room and they \_\_\_\_ table and **dined**.

6. They **go** to their bedroom and they **put** on their clothes.

KB. They **put** the bedroom and they've \* **dressed** \_\_\_\_\_ clothes.

*\*so (on) has have had [these last four written after 'they've' as a list*

7. They **go** downstairs.

KB. They **go** ~~out~~ **descend** the steps.

8. They **shake** hands with the guests.

KB. They ~~elaps~~ **clasp** their ~~h~~ hand.

9. Then they all **go** into the dining room.

KB. They **go** in the dining room.

10. But there's no food!

KB. All the ~~fed~~ **w** not food.

11. The husband **goes** to the fish and chip shop.

KB. The husband **go** the chips & ~~fished~~ a shop.

12. Then they **sit** down in the dining room, **eat** the fish and chips and **have** a good time.

KB. They **seat** in the dining room, and **eat** the chips and fish. They **laughed** the food supper.

# Jogging

